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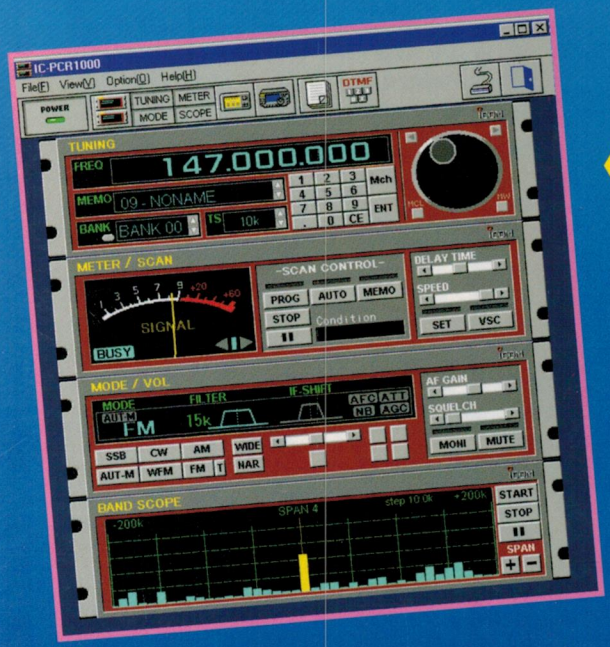
PREVIEW: PHILIPS' NEW DVD VIDEO DISC PLAYER

NDD

Electronics

AUSTRALIA WITH Professional Electronics & ETI

APRIL 1998

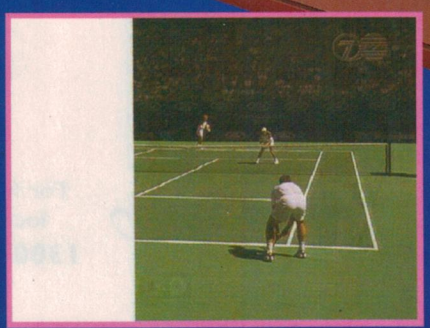


HANDS-ON REVIEW: Icom's new PC-driven radio receiver — with 'virtual front panels'

THOSE ELECTRONIC CANCER CURES: WERE WE UNFAIR?

Build our new low cost Fader/Wiper for editing your videos...

VERTICAL WIPE TO BLACK...



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FPC MAGAZINES

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Where do you GO for the inside buzz on multimeters...

Handyman's 34-range Multimeters

Great for around the house, on the boat or on the job, this 34-range Digital Multimeter has 3.5 digit (2000 count) display, pop-up LCD screen for adjustable viewing angle, Diode testing , audible continuity testing, transistor testing and low-battery warning.

Ranges:

DC V:	200mV, 2, 20, 200, 1000V
AC V:	200mV, 2, 20, 200, 750V
DC A:	200uA, 2mA, 20mA, 200mA, 10A
AC A:	200uA, 2mA, 20mA, 200mA, 10A
Resistance:	200, 2K, 20K, 200K, 2M, 20M, 200M ohms
Capacitance:	2nF, 20nF, 200nF, 2uF, 20uF

Q 1429

$69

Measure Mains Safely

24-range Digital Multimeter. Play it safe when testing your 240V domestic main. This meter is suitable because it can deal with momentary power surges or spikes of over 1000V which may occur on domestic mains. It has a 3.5 digit(2000 count)display, max hold and data hold, diode and continuity testing and a protective rubber holster.

Ranges:

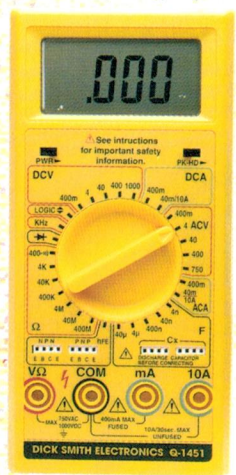
DC V:	2, 20, 200, 600V
AC V:	2, 20, 200, 600V
DC A:	200uA, 2mA, 20mA, 200mA, 10A
AC A:	200uA, 2mA, 20mA, 200mA, 10A
Resistance:	200, 2K, 20K, 200K, 2M, 20M ohms

Q 1563

$99

Multi-Function Multimeter

This 32-range Digital Multimeter features large 3.75 digit (4000 count) LCD, pop-out stand, auto-polarity, capacitor/diode/transistor test, logic circuit test, frequency measurement (up to 4MHz), peak reading hold, continuity test, soft carry case and test leads.



Ranges:

DCV:	400mV, 4V, 40V, 400V, 1000V
ACV:	400mV, 4V, 40V, 400V, 750V
DC Current:	40mA, 400mA, 10A
AC Current:	40mA, 400mA, 10A
Resistance:	400, 4K, 40K, 400K, 4M, 40M, 400M ohms
Trans check:	hFE (NPN/PNP)
Capacitance:	4nF, 40nF, 400nF, 4uF, 40uF
Freq measure:	Auto-ranging 4K-4MHz (4 scales)
Logic measure:	TTL type

Q 1451

$129

Digital Clamp Meter

This meter features high resolution, ACA current measurement up to 700 Amp, peak and data hold function.
DC volt 600 V +/- 0.5%,
AC volt 200/600V+/-1.2%,
AC current 20A range +/- 1.5% 50/60Hz,
+/- 5% 40/500Hz
200/700A ranges +/- 1.5% 50/60Hz,
+/- 3.5% 40/500Hz,
Resistance 2/200k +/- 1%,
Frequency auto-ranging
up to 20KHz +/- 0.1%,
Diode test function, continuity
<100ohms, 600VDC/600VAC
overload protection in Diode,
Ohm, Hz, continuity.

Q 1475

$139

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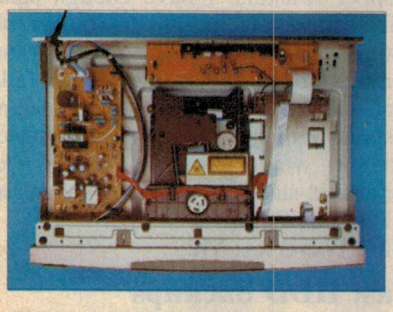
Electronics

AUSTRALIA with Professional Electronics & ETI

Volume 60, No. 4
April 1998

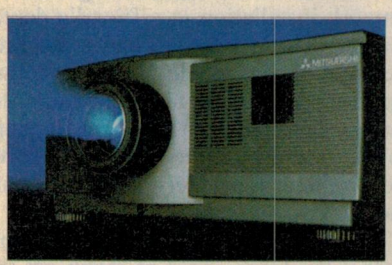
AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE — ESTABLISHED IN 1922

The future of home video



The new Philips DVD840 may look much the same as your existing CD player — even inside the case — but in reality it's a glimpse of the future for home video entertainment. It plays the new DVD video discs in addition to audio and video CDs, and can deliver superb video and audio quality — see page 30.

And with it (you wish)...



Of course an LCD video projector like Mitsubishi's new LVP-X100A would really let you take full advantage of DVD video, and recreate an authentic cinema experience. There's only one small problem — you may not be able to afford it. See our review, starting on page 10.

On the cover

Unlike traditional communications receivers, Icom's new PCR1000 gives you a choice of three front panels — because they're all 'virtual', on the screen of your PC. (See page 22) Our new Video Fader/Wiper design lets you achieve basic video effects when editing your videos; see page 46 for details. (Photo by Michael Pugh)

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Projects and Technical

Columns and Comments

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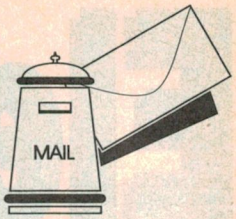
LETTERS TO THE EDITOR



Valve amplifier

It did my old valve man's heart good to see the story of a new valve amplifier kit in the January 1998 issue. However, with due respect to the designers and promoters, I do have some reservations.

Firstly, it is news to me that hifi valve amplifier buffs ever went in for single-ended output stages, parallel or otherwise. If you use two valves in the output, surely the obvious way to go is push-pull, and class A if you want the ultimate; but class AB1 triodes, especially with some negative feedback, are a very acceptable compromise. For example, the mono Playmaster No.5 of 1951 with 2A3s in AB1 was a beauty. Certainly push-pull means a centre-tapped primary in the output transformer, and an extra valve for phase splitting, but the extra is not a huge proportion of the overall cost.

Secondly, fixed bias, rather than self-bias, for the output stage seems to be unnecessarily complicated. Self-bias is to a certain extent fail-safe. A power output stage has very little DC resistance in the anode circuit to limit current flow; if a separate fixed bias supply fails, then away goes your 'bottle' in short order. Self-bias can be as readily adjustable as can fixed bias.

Thirdly, the distortion figures quoted seem rather high in the hifi context, and compare unfavourably with 'classics' like the Mullard 5/10, the Leak, the Quad and all the higher power Playmaster valve amps. Significantly, they were all push-pull circuits.

Fourthly, if the actual amp is wired according to the published circuit on page 20, the distortion level is not surprising, since the input stage has zero bias; R1 and C1 are redundant.

On the credit side, that immaculate under-chassis wiring is a delight to the eye. The old-fashioned point-to-point wiring is undeniably tedious to carry out compared with PCB construction (I particularly dislike laying down the heater wiring), but my word, servicing is a doddle in contrast to repairing PCB circuits. To service some PCBs you need to be a contortionist and/or possess X-ray vision, to see what goes where.

As a footnote, my own stereo installation is a valve job, the Mullard Stereo Ten/Ten, still sounding good after all these years. I have had to replace one EF86, and one of the 6GW8 screen stopper resistors. I have enough spare valves to see me through the foreseeable future, but if one of the output transformers or the power transformer fails, that will be that. The cost of replacing just one of those, even if possible (which I doubt), would just about buy me a kit for a solid-state Playmaster replacement.

Douglas Bolton
Mt Waverley, Vic.

Fast HDD backups

I have been reading your magazine since the days of *Radio & Hobbies* and have found it invaluable for information and ideas. I returned to TAFE recently, to upgrade my electronics and computer knowledge, and used many articles to assist with my studies.

I thought that I may be able to return the favour in a small way by sharing a recent idea that I used during a small network installation in a friend's dental surgery. The gentleman had a requirement for a reasonable sized streaming tape backup unit, as the area where the surgery is situated suffers from frequent power outages. The only way to solve the problem adequately was to fit this and a UPS.

The dentist also required fast backups, so that the tapes could be taken off the premises after hours. As he also had other PCs at home he wanted a portable backup unit.

The current parallel port units are too slow for the purpose, and a SCSI unit was out of the question, for several reasons, so I opted for one of Seagate's new IDE interface 8GB internal units. This may sound odd at first, but I installed it using one of the 'Mobile Rack' HDD carriers sold by various suppliers these days. The carrier only required a rectangular hole cut in the front panel and a slight amount trimmed off the internal power connector. (This drive is much longer than a HDD). I did the same with the other PCs at the gentleman's residence and he now has a very fast backup (60MB/minute) and also has a convenient method of transferring large files, quickly, between

several non-networked PCs.

The backup unit was installed as a slave to the CD-ROM on the secondary IDE port in all the PCs and there are no problems using any of them with or without the drive in place, and no settings require altering prior to slipping the drive into place.

Incidentally, the carriers that I used were $50.00 each and not only came with a very nice shoulder carry bag included, but also had a power switch incorporated in the front locking mechanism which doubled as a barrel switch.

I hope this information may be of use to somebody.

Stephen Turk
(via e-mail)

Frequency shifter

Since 1939 I have been a reader of your magazine. My first project was 'Little Jim', followed the next year by 'The Little General', so I go back quite a way. Like yourself I started out my working life at AWA at Ashfield, but after six years I left to eventually spend my working life in the Electricity Supply Industry.

I am writing to say how much I have enjoyed your magazine over all these years. The projects I have built are too numerous to mention, but following the completion of my last project I thought it was about time I gave your publication the thanks it so richly deserves.

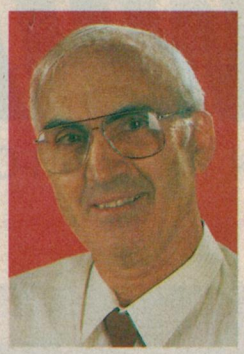
Over some years I have been involved in the establishment of a sound system in St Augustine's Anglican Church in Newcastle, and as you know churches can be very difficult to tame when it comes to such problems as acoustic feedback. When I saw Phil Allison's article on Audio Frequency Shifting in the August edition, I couldn't heat my soldering iron quickly enough!

On completing this project I wish to report that our congregation now have a first class sound system — plenty of sound and no sign of 'ringing'. Incidentally I also use Phil's low-noise balanced input mic preamp (*EA* December 1984) in the mixer. So once again many thanks for providing me with the means by which to experience 60 years of enjoyment of a great hobby.

Peter King, VK2QK
(via e-mail) ❖

Letters published in this column express the opinions of the correspondents concerned, and do not necessarily reflect the opinions or policies of the staff or publisher of Electronics Australia. We welcome contributions to this column, but reserve the right to edit letters which are very long or potentially defamatory.

EDITORIAL VIEWPOINT



Digital TV broadcasting: You'd love cinema-quality HDTV, right?

As the old saying goes, statistics can be used to 'prove' almost anything you want. And one of the time-honoured ways of doing just that is by means of a carefully managed survey, isn't it?

I was reminded of that a few nights ago, when the phone rang just as my family and I were sitting down to our evening meal. When I answered it was a very diplomatic woman asking very pleasantly if I'd be prepared to answer just a *few* questions, for a 'marketing survey'. It was hardly convenient, but I agreed to do so — largely because I'm aware that most telesurvey operators are casual workers, paid poor rates and largely on the number of responses they get...

Anyway, it soon became clear from the questions what the survey was all about. Was I aware that digital television had been developed? Did I know that it would allow the TV stations to broadcast movies in high-definition cinema quality, right into my lounge room? Was I aware that in order to receive such HDTV transmissions, I'd need a new digital TV set? How much would I be prepared to pay, for a set able to receive these transmissions? Was I aware that various other countries had decided to approve digital HDTV broadcasting, but Australia's own government *still* hadn't done so? Did I believe the Federal Government was right in delaying the introduction of digital HDTV to Australia? Did I agree with the idea of giving existing analog broadcasters the free use of an additional channel for parallel broadcasting for a limited time, to help both them and the viewers make the transition to digital technology?

I didn't need Einstein's IQ to work out that the survey had probably been commissioned by the commercial TV broadcasters. They seemed to be trying to gauge what the public really thought about digital terrestrial TV and HDTV, what they'd be prepared to pay, whether they'd support the idea of free channels for parallel broadcasting, and so on. Fair enough, too. If I were facing growing competition from Pay-TV and looming competition from DVDs, and also the heavy costs of moving over to digital broadcasting, I'm sure *I'd* want to gauge market feelings too...

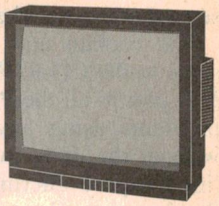
All the same, I couldn't help but notice that some of the survey questions were quite leading — if not 'loaded'. The prospect of 'cinema-quality HDTV with superb CD-quality surround sound' was clearly being used to present digital broadcasting in the most enticing possible light, when we all know that the HDTV option is largely a Trojan horse. The sets will be so expensive that in the short-to-medium term there'll be a tiny viewing audience for HDTV; the *real* potential of digital, from a commercial payback point of view, is clearly its alternative ability to provide multiple medium-definition compressed video channels ("six times the advertising potential!").

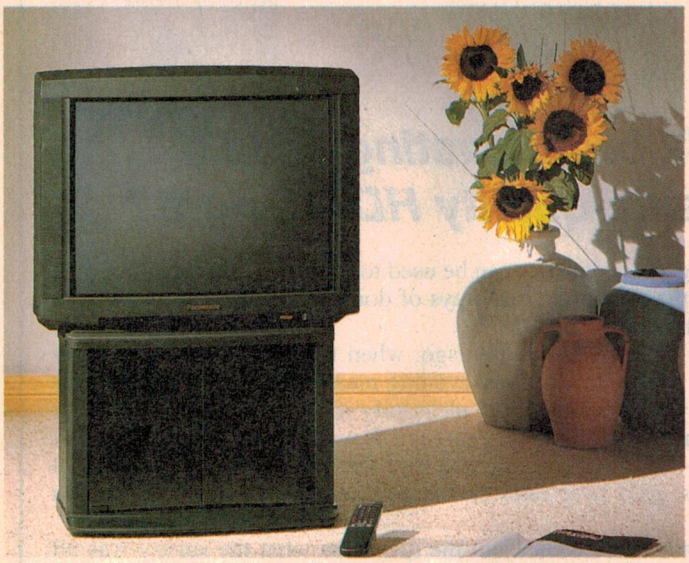
As an engineer (albeit somewhat rusty), I'm as keen as the next person to see Australia move to digital TV broadcasting. It's the future; simple as that. But let's be honest about it, folks, and not try to con anyone.

Jim Rowe

WHAT'S NEW

IN THE EVER-CHANGING WORLD OF ELECTRONICS





68cm CTV has double-rate scanning

Pansonic's new TX-29AD50F stereo television offers virtually flicker-free images on its 68cm 'super flat' screen, thanks to a frame doubling system which gives 100Hz scanning. Incoming video is also analysed and automatically compensated for losses, to optimise picture quality.

Other features of the set include 10 watts/channel stereo surround sound, a built-in '3D Super Bass' subwoofer and an AV output as well as three AV inputs. The set also accepts NTSC video in addition to PAL, and comes with a free purpose-built stand.

The Panasonic TX-29AD50F is available from leading electrical retailers for an RRP of $3699. For more information circle **155** on the reader service card or ring Panasonic's Customer Care Centre on 132 600.

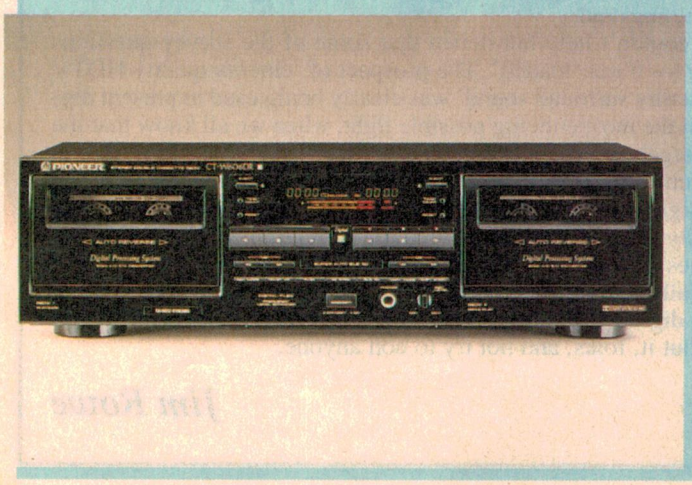
Video conferencing for the masses?

Video conferencing has been around for a while, but well out of the price range of small-medium sized businesses and organisations. But Ericsson Business Systems and Sony Australia now claim to have come up with an affordable video conferencing solution, by teaming up Sony's TriniCom system with Ericsson's BusinessPhone 250 telephone system.

Ericsson Business Systems GM Stuart Mitchell believes that the partnership takes videoconferencing out of the boardrooms and into the domain of everyday business use. Sony's James Waldron adds that beyond being a meeting money saver, videoconferencing is 'enabling technology'.

The Sony/Ericsson videoconferencing systems cost between $6000 and $45,000, which it's claimed can be deployed cost effectively through organisations with typical payback periods of 18 months. For more information circle **140** on the reader service card.

Cassette deck offers digital processing



Pioneer's new CT-W606DR double cassette deck incorporates a digital signal processing (DSP) said to challenge the limits of traditional cassette recording. The CT-W606DR uses 20-bit A/D and D/A converters to convert the analog signal into digital form, allowing all internal processing to be performed in the digital domain.

The DSP system intelligently isolates hiss noise and removes it without affecting other signals. Equally impressive, it achieves a signal-to-noise ratio of 90dB, almost as wide as that of a CD.

The technology enables noise to be removed from any recorded tapes, even old ones, as well as dubbed tapes. In addition the digital processing makes possible other innovative features: Digital FLEX (frequency level expansion), Digital Super Auto BLE XD (automatic optimisation of bias level and equalisation) and Digital TDNS (tape duplication noise suppression).

The CT-W606DR also offers Dolby HX Pro (Deck II) and Dolby B/C noise reduction with built-in MPX filter. It carries an RRP of $599 and is available at Pioneer dealers throughout Australia and New Zealand. For more information circle **146** on the reader service card or contact Pioneer on 1800 060 852.

'European' speakers from Pioneer

Pioneer has released a new range of European-made speakers for listeners, led by the Prologue S-200 and the S-4UK. Both speakers employ a speaker layout that positions the woofer higher and the tweeter lower, so that sound from the woofer and tweeter arrives at your ears simultaneously for maximum performance and effect. They also use what Pioneer calls two-way 'Network Free' crossover technology, where a single capacitor is employed in place of the traditional crossover network. This is said to give cleaner sound.

The Prologue S-200 is a floor standing two-way speaker system, with the two woofers in line and the tweeter at the centre. It uses two 160mm cone woofers and a 25mm ceramic carbon dome tweeter, and offers a power handling capability of 120W (DIN).

The S-4UK is a two-way bass reflex bookshelf system with a direct drive 140mm woofer with a diffuser and 25mm dome tweeter, and handles 80W (DIN) of power.

The Prologue S-200 has an RRP of $1899 and the S-4UK and RRP of $599. For more information circle **144** on the reader service card or contact Pioneer Electronics Australia on 1800 060 852.

Projector is *really* bright

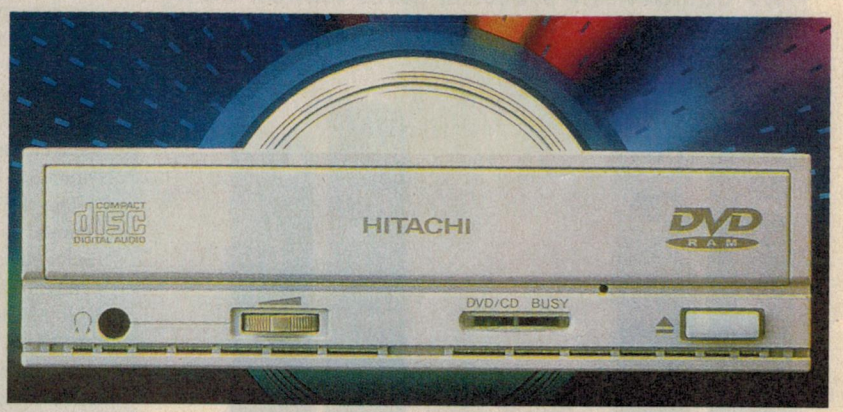
Hitachi's new CP-L850 multimedia projector uses three LCD panels and is claimed to provide a light output of 650 ANSI lumens, achieved using Hitachi's proprietary Polarisation Converter. This is especially bright, and claimed to make the projector ideal for use in well lit rooms. The CP-L850 offers SVGA resolution (800 x 600 pixels), and can also display XGA (1024 x 768) format in compressed form.

A rugged frame protects the unit from transit damage and distortion when used in difficult environments so often found in educational and training situations. For further protection the zoom lens is fully mounted within the projector case and a built-in shutter protects the lens from accidental scratching.

The CP-L850 accepts two PC inputs, two S-Video and two composite video inputs which are automatically detected. The display resolution is adjusted automatically depending on the signal frequency. A separate monitor can also be attached for remote display — particularly helpful when the operator cannot see the main screen.

The CP-L850 is available from authorised Hitachi dealers Australia wide, for an RRP of $9995 including tax. For more information circle **141** on the reader service card.

DVD-RAM drives reach Australia



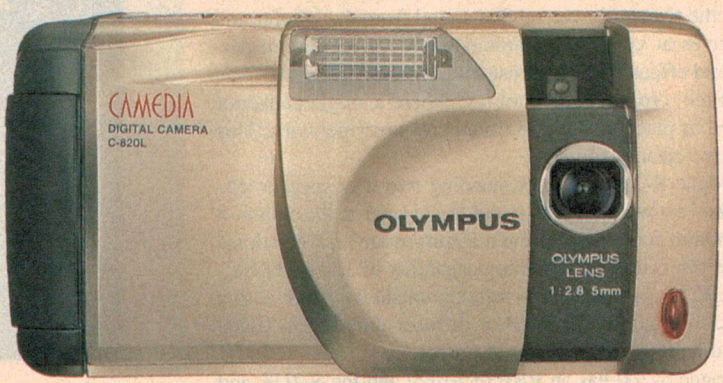
In late March, Hitachi Australia will begin delivering the GF-1050, claimed as the world's first DVD-RAM drive for personal computers. The new drive complies with the DVD-RAM format announced recently by the DVD Forum and features high capacity, full rewritable capability and compatibility with existing CD and DVD devices.

DVD-RAM is a rewritable DVD format that offers a large storage capacity of 2.6GB per disk side (equivalent to 1800 floppy disks) and 5.2GB if both sides of the disk are used. Data rate is a very high 1.38MB/s in DVD-RAM mode. As well as portability and very high reliability in reading and writing of data, the drive is said to offer full compatibility with other DVD formats such as CD-R and RW.

The GF-1050 features a 650nm laser mounted in a special double lens/double-laser head, a high-speed DSP chip set and a high-speed mechanism. It has a double-speed data rate in DVD-ROM and DVD-R modes and is compatible with all CD-ROMs. A separate 780nm IR laser handles CD-R disc reading functions. The tray loading system permits operation in either horizontal or vertical orientation.

The GF-1050 features a SCSI-2 interface and comes in a half-height case for internal mounting. It will be available from major Australian dealers at an RRP of $1580 including sales tax. For more information circle **145** on the reader service card.

Improved digital cameras from Olympus



Olympus says its new C-820L and C-420L are 'second generation' digital cameras, combining ergonomic design, acclaimed image quality performance, easy operation and several key new features. The C-820L (designated D-320L in North America) has already received acclaim in US computer product awards.

The C-820L offers 1024 x 768 pixel resolution, while the C-420L uses a 640 x 480 pixel progressive scan CCD. Features common to both models include an all-glass aspherical f2.8 autofocus lens, use of SmartMedia removable memory cards, a PAL standard video output and three levels of storage compression. The cameras also feature a 50mm smudge-resistant TFT colour LCD screen in addition to the optical viewfinder.

A built-in auto flash provides 'red eye' reduction, fill-in, and flash off modes. The cameras weigh approximately 265 grams and comes with a 2MB SmartMedia card plus connection kit for Windows PC (3.1/95/NT4.0) and Mac PCs, with Camedia utility software, TWAIN driver, and Kai's PhotoSoap imaging software.

Approximate Australian RRP figures are $1499 for the C-820L and $949 for the C-420L. For more information circle **148** on the reader service card or contact R. Gunz Photographic, Locked Bag 690, Beaconsfield 2014.

Lightweight video projector

3M Australia has just released a new and highly-portable multimedia projector, the MP8620. Weighing only 5.2 kilograms and fitting easily into a conventional briefcase, it is claimed to be ideal for travelling.

Additional features of the MP8620 include a folding mechanism to protect the lens, a remote control, joystick and inbuilt keystone correction to ensure a square projected image.

The projector offers an impressive 450 ANSI lumens of on-screen brightness and true SVGA (800 x 600) resolution to meet the display demands of today's notebook computers. The long-life metal halide lamp systems also allows for bright, sharp and colourful images. Its two computer input channels integrate with both IBM and Apple Macintosh models, and the two video inputs are NTSC, PAL, SECAM and S-VHS compatible.

The MP8620 is available for sale at leading visual specialist dealers. For more information circle **147** on the reader service card or contact 3M on 1800 023 423.

AV component systems offer Italian design

Kenwood has collaborated with leading Italian designer Giorgetto Giugiaro in designing its new Series 21 audio-visual component systems, claimed to 'push the frontiers' of digital audio performance and create new standards in system design.

The new series comprises three systems — the C777R, the C135R, and the R315R. Each system is made up of pre-amp/amp or receiver, speaker package and multiple CD player, with the possibility of expansion by adding other Series 21 components.

The C777R is top of the line, with its C-V700 Preamplifier claimed to offer unparalleled home theatre and audio sound. Included is Dolby Digital (AC-3) technology delivering six independant discrete channels of sound, plus Dolby Pro-Logic and Dolby 3 Stereo. The M-A300 Power Amplifier compliments the pre-amp with six 100W RMS power amp channels, using individual power transistors and other circuit components to assure low distortion and high operating safety margins.

The C777R also includes the D-R350 five-disc CD player, featuring Kenwood's DRIVE (Dynamic Resolution Intensive Vector Enhancement) system.

The Series 21 systems start at $1699 and are covered by a 24-month parts and labour warranty. For further information circle **142** on the reader service card or contact Kenwood Electronics Australia.

CTV, VCR offer two-speaker surround sound

Hitachi Australia has introduced two new fully featured home video entertainment products which are claimed to provide an effective, lower cost alternative to expensive, multispeaker surround sound systems. The VTF86E video cassette Recorder and the CMT2985 69cm colour television both feature Spatializer, a surround sound process developed by Desper Products Inc in the USA and licensed to Hitachi.

Originally created by legendary Beach Boys recording engineer Stephen Desper and used in professional sound studios, Spatializer technology provides a listener with an 'over the shoulder' sound illusion placing sounds anywhere within an arc spanning 270° around the listener. This effect is best realised when heard through an external amplifier with two stereo hifi speakers angled directly at the listener, or used with the new Hitachi CMT2985 CTV with its built-in stereo speaker system.

The Hitachi VTF86E VCR has both PAL and NTSC compatibility, a total of six heads for maximum fidelity and flexibility and caters for both SP and LP recording and playback.

Complementing the VCR is the CMT2985, a 69cm Super Black Screen television which automatically adjusts picture contrast to the lighting conditions in the viewing room. It features two 10W acoustic horn speakers and a 20W subwoofer located in a special compartment on the top of the unit. The VTF86E VCR is available at an RRP of $749, while the CMT2985 CTV is priced at $1799. Both units are available from Hitachi retailers. For further information circle **143** on the reader service card.

Panasonic's new micro hifi system

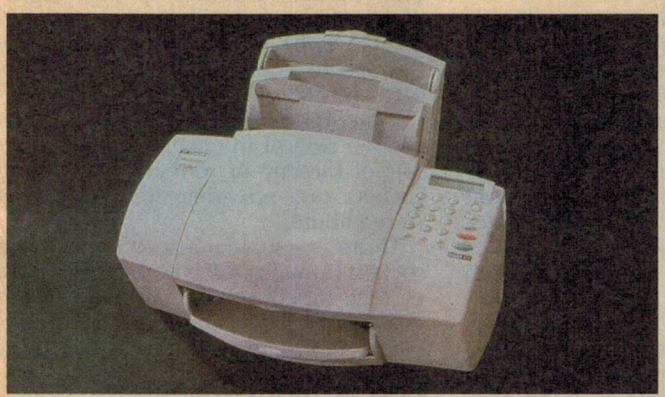
Panasonic has aimed its new SC-PM15 micro hifi system at people who want a compact stereo system with the best possible sound output. It has a power output of 20 watts (RMS) per channel and a 'power-glide' control panel. At the press of a button, the whole panel will retreat and expose the control knobs.

The speakers are in separate enclosures and include a subwoofer for rich bass sound.

The SC-PM15 has a single front-loading CD player with Panasonic's 'MASH 1-bit' and Digital Servo technology. It also includes a single auto-reverse tape deck and quartz-synthesised FM/AM digital tuner. Other features include a multi-function remote control, 'Sound Virtualiser', tape program sensor and large back-lit LCD display. The system is available from leading electrical retailers for an RRP of $549.

For more information circle **149** on the reader service care or contact Panasonic's Customer Care Centre on 132 600.

HP expands OfficeJet all-in-one family



Latest addition to Hewlett-Packard's very successful all-in-one products is the OfficeJet 635 colour printer-fax-copier-scanner, which combines colour printing, colour copying and colour scanning with full-featured plain-paper faxing at estimated street price of $999 including sales tax.

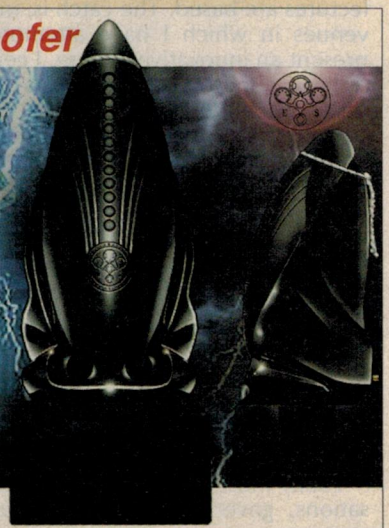
HP says the OfficeJet 635 offers customers a full-colour, easy-to-use device that allows them to produce a wide variety of professional-quality colour documents, at home as well as at the office. It prints crisp black text at five pages per minute (ppm) and vivid colour images at 2ppm, and also features HP ColorSmart, an HP-developed technology that automatically selects the best settings for photo images, text and graphics — reducing colour printing to a single mouse click.

The 635's scanner produces clear, accurate scans using 1200dpi enhanced color scanning, 24-bit colour and 256 levels of greyscale. It's supplied with Corel Print & Photo House Select 2.0 and Caere OmniPage Limited Edition OCR software, which converts printed text into an editable electronic form.

The new all-in-one also features advanced fax capabilities, including enough memory to store 65 pages; a transmission rate of 6ppm; up to 100 programmable speed dials; and a 14.4kb/s modem. For more information circle **150** on the reader service card or contact Hewlett Packard Australia on 131 347.

Unique subwoofer

University of Newcastle industrial design graduate Philip Tejszerski came up with this innovative subwoofer design as his final-year project. The cabinet is in two pieces, both cast in clay and kiln-fired, and each a separate enclosure containing two Audax 130mm drivers.
For more details you can contact the designer on 44carina@tig.com.au or (02) 9528 6101. ❖



MITSUBISHI'S LVP-X100A LCD VIDEO PROJECTOR

This month Louis Challis has been casting his critical eye over a rather different product. Mitsubishi's new X100 is a lot more than just a 'me too' video projector, with impressive extra features like correction for keystone distortion and the ability to make data presentations without the need for an accompanying PC. That's quite apart from its excellent image resolution and high brightness...

When they were released in the early 80s, the first generation of LCD video projectors were singularly unimpressive in their performance. The pictures they projected were uniformly dull and lacked definition. Yes, I acknowledge that they were technically novel — but that certainly didn't compensate for the disproportionate relationship between price and performance. Conventional CRT projectors and back-projection TVs were unquestionably superior, and few people were prepared to consider purchasing an LCD video projector.

Of course in the intervening period, the computer industry has funnelled research funds into the development of LCD panels. As a result, their technical capabilities and overall performance have improved at an incredible rate. One of the most obvious spin-offs of such development has been a new generation of active-matrix LCD panels which can handle the extreme levels of heat and light associated with big-screen projection.

As an itinerant lecturer, I crave for the ability to achieve optimum presentation of the slides and computer-generated graphs on which the bulk of my lectures are based. The catch is, in most venues in which I have attempted to present an innovative lecture, I generally have a problem obtaining an overhead or slide projector, let alone expect to find that the venue will offer more advanced capabilities. Apart from a limited number of hotels in major cities, virtually none of the major venues offer projection TVs. Those that do, simply don't make allowance for the computer generated graphs and information on which most of my lectures are based.

Faced with an intractable problem, I and most other lecturers are forced to prepare slides or overhead transparencies, which invariably lack the panache that the material is capable of offering.

Today most large commercial organisations, government departments and even tertiary institutes are prepared to provide superior resources, especially when the end result can result in a sale. The catch is, in order to achieve that goal the organisations frequently have to bring a carload of equipment, with a bevy of strong people to carry it.

With few exceptions, that's how it was until late 1997 when Mitsubishi released its exciting portable multimedia data/video LCP-X100 projector.

The press release boldly claimed that the compact and durable X100 projector guarantees a simple set-up, plus unsurpassed convenience in projecting almost any form of digital or video based material. That sounded too good to be true, so I immediately decided that this was one product that we should review, if only to disprove the voluble claims.

I was intrigued by the large number of features and performance attributes claimed. These included installation convenience, with the ability to remotely control the unit from either its front or its rear.

More significantly, the unit works on any normal voltage from 100 volts to 250 volts, and any frequency without external adjustment. It also provides power zoom and focus, and provides electronic keystone correction with increments of 2-16°, which is an outstanding feature.

On examining these primary features, I couldn't avoid the feeling that it looked for all the world as if the marketing people had walked into Mitsubishi's R&D department with a list of every conceivable feature they could dream up, in order to whet an intending purchaser's appetite.

Happy surprise

When the X100 arrived I immediately evaluated all its primary functions and features, firstly in my laboratory and then at home. Much to my surprise, I found that all the advertised features and claims were true, and that Mitsubishi Electric had indeed developed a superior product which fills a special market niche, for which I and others have been patiently waiting.

Foremost amongst its most outstanding features are that it is a comparatively small, and relatively lightweight unit. It provides a superlative colour-balanced image, with a light output of 600 lumens which is well suited for use in a medium sized darkened lecture hall, and it is equally at home in 'home cinema' applications. It can handle signals from almost any type of TV tuner, video recorder, laserdisc player or DVD player — quite apart from DOS or Mac based computers, and other brands and formats as well.

It happily accepts the two primary NTSC systems, PAL, SECAM and S-VHS formats. It will immediately display any one of half-a-dozen colour digital graphics formats including conventional VGA (640 x480) pixels, all the way through to compressed SXGA (1280 x 1024 pixels).

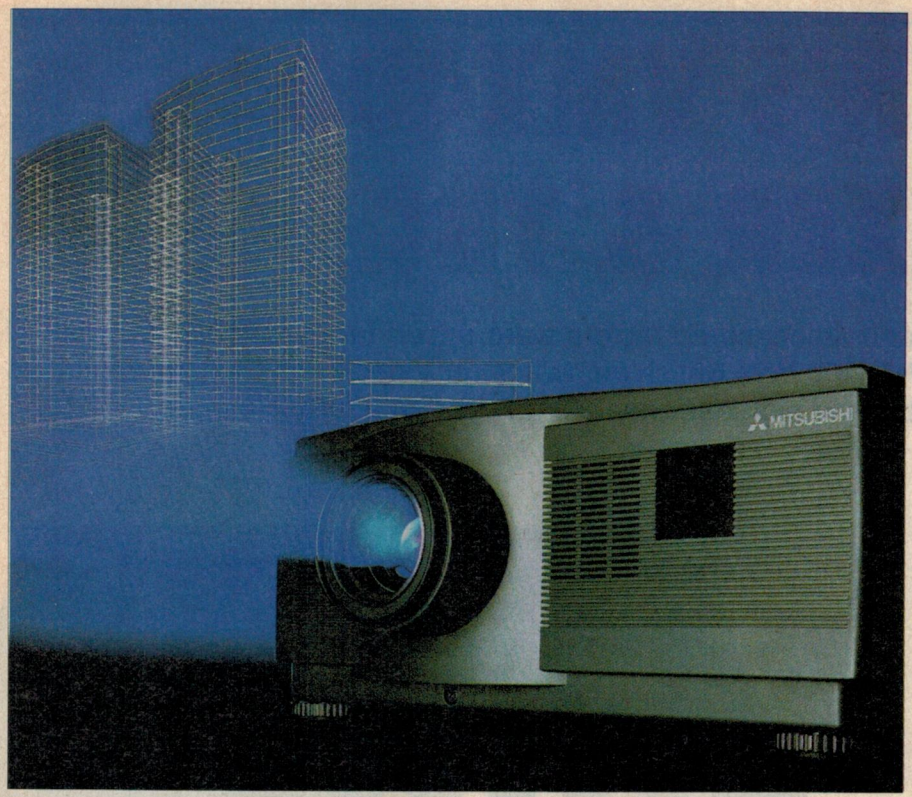
It incorporates an input/output panel on one side of the cabinet, where two sets of directly or remotely switchable sockets are provided for video and stereo/audio.

Those are supplemented by separate sockets through which both DOS based, or Mac based computers, and/or their displays may be simultaneously interfaced, and remotely controlled to boot.

Can be self contained

But one of the X-100's most exciting and 'user-friendly' features is the ability to dispose of all external connections, and load all the material into one of two internal PCMCIA flash memory cards, each of which has a 20MB capacity. The projector can then present the material for you, without any accompanying computer.

The preferred way of programming the PCMCIA cards is with your computer. However, an equally convenient way is to grab an image from material which you are in the process of display-



ing from another source, by 'freezing' it and then automatically transferring the frozen image onto the PCMCIA card, using the X100's inbuilt capability.

The only way to learn how flexible the X100 actually is, and how much panache it has to offer is to sit down with its handbook, find out what it does offer, and how you access its exceptional capabilities. That is precisely what I did, and as its inbuilt story unfolded, I discovered just how flexible it really is.

Perhaps its most attractive feature is the ease with which you can interrogate its functions directly on the screen. You either use the remote control or the delightfully simple illuminated controls on the top of the cabinet.

There are a hierarchy of control functions in three different groups under six different menu headings, the most helpful of which is the HELP menu to which you are only likely to make reference on the first couple of occasions that you use the X100.

The other menu headings are associated with normal usage for setting CONTRAST, BRIGHTNESS, TINT, COLOUR and GAMMA CORRECTION. The first of those are self evident, whilst the last is the most interesting — providing a means of altering the differential ratio between the input signal's brightness and its displayed brightness.

The ENHANCED group of menu functions provide all the possible options of IMAGE REVERSAL and ROTATION, ZOOM and SOURCE IDENTIFICATION, BLUE or BLACK BACKGROUNDS, and by no means last, five very practical TEST PATTERNS which you can project onto the screen. It also provides the option of zooming, superimposing and selecting a picture-within-a-picture mode, or superimposing other data.

One of the most unusual functions is the POINTER, which duplicates many of the more useful functions that you will find in a computer paint program, replicating many of the most functional characteristics of the early MacPaint programs. This function simplifies putting emphasis, underlying or drawing your own sketches or pictures on the screen, particularly if you have an artistic capability coupled with appropriate manual dexterity whilst using the unit's handy remote control.

The AUDIO menu allows you to adjust the output volume of the two one-watt amplifiers and loudspeakers incorporated at the front of the cabinet, or to mute them, should you so choose.

The menu OPTIONS heading allows you to select and receive information from external or internal sources, to FREEZE and DOWN-LOAD pictures, to select an alternative language other than English for the menu and displays, to AUTOMATE the display functions with pre-determined sequential display times, switch-off times and even repetition of video slides, so as to conform to your pre-ordained presentation schedule...

Trying it out

Whilst in my office, I inter-connected my Power MacIntosh with the X100, and was pleasantly surprised to find that the projected and enlarged image on my office projection screen was every bit as sharp, and equally colourful as it is on my new 17' video screen.

I then took our new 260MHz MMX computer with its SXGA output, which forms part of our office CAD system, and with no more effort was able to display its superlative quality directly onto the same projection screen in my office.

At home I watched both NTSC and PAL based laserdisc videos, and was equally impressed with the superlative resolution, outstanding colour balance, and more importantly, my ability to vary both the colour balance and picture contrast, as well as the size and resolution of the picture to satisfy my every whim.

The keystone correction feature proved to be an absolute delight in use, and converted an upward angled picture from a disturbing trapezoidal display into a conventional rectangular one, with only the slightest trace of irregularity at the extreme edges of the projected image.

Overall, this is one of the most outstandingly 'user friendly' and simple to use items of video lecturing equipment that I have yet had the pleasure to use, and indeed it did prove to be an *absolute pleasure* to use.

Whilst its primary design intent appears to have been to satisfy the high powered, or high profiled requirements of a lecturer who wants to achieve the best possible result, with the least possible effort, the X100 will undoubtedly moonlight in many residences, colleges or offices, fulfilling other less demanding, and possibly more rewarding areas of interest.

Whilst the LVP-X100 currently costs nearly $13,000, make no mistake. This is the one item of gear that your organisation will have to test drive, just to confirm that its multi-functional talents are precisely what you have been waiting for. ❖

Mitsubishi *LVP-X100A* projector

A multimedia data/video colour LCD video projector offering true XGA (1024 x 768) resolution and high brightness — 600 ANSI lumens. Features built-in 'intelligence', allowing it to make presentations from data stored in PCMCIA flash card memory, without the need for a PC. Measures 385 x 330 x 145mm, weighs 10kg.

Good points: Very user friendly, especially in its ability to make free-standing presentations. Excellent image quality and brightness; very nice keystone correction facility; able to display 1280 x 1024 images in compressed form.

Bad points: Virtually none, although we could wish for a lower price...

RRP: $12,995

Available: Mitsubishi Electric Australia, 348 Victoria Road, Rydalmere 2116. Phone (02) 9684 7777.

VIDEOTECH'S VMX400 VIDEO MIXER & TBC

Until very recently, video mixers and timebase correctors were priced far outside the budgets of home video enthusiasts. But the VMX400 from British manufacturer Video Tech Designs combines both functions in a compact, flexible and high performance unit, for an affordable price.

by JIM ROWE

As anyone who's tried it will know only too well, copying video programmes using even high-end domestic VCRs generally gives fairly disappointing results. Image resolution rapidly degrades, and timing jitter tends to upset the relationships between sync pulses, colour bursts and the actual picture luminance and chrominance — giving jaggy outlines and other nasties. Even worse, the much lower colour bandwidth of domestic VCRs means that colour resolution degrades even faster than luminance, giving awful 'colour bleed' effects: areas of colour expand beyond the outline of their matching luminance outline and are delayed so that they tend to move to the right and down, making areas of vivid colour look especially 'mushy'.

Video professionals have long overcome these problems by using timebase correctors or 'TBCs', which re-synchronise all of the components in the video to restore its stability. This also allows the resolution to be restored, without simply making the timing problems more evident. But until very recently the cost of TBCs was far beyond the budget of most amateurs, running into many thousands of dollars.

Video mixers were in much the same boat. To mix two video signals together, they need to be already locked together in terms of timing. Professionals do this by running most of their video sources from a common 'master' timing generator, 'genlocking' the output of video recorders to the same timing reference, and/or using TBCs for the same purpose. All of which was again well beyond the reach of amateurs, at least until the advent of low-cost digital technology...

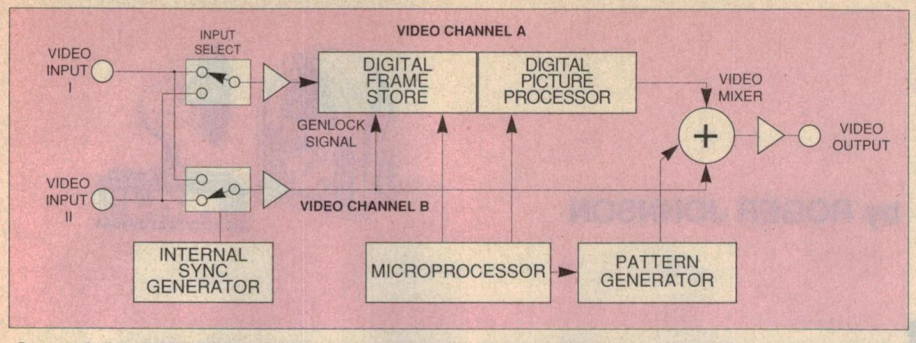
But as the Video Tech Designs VMX400 shows, things are now looking a lot brighter for the video amateur. The VMX400 can be used as both a TBC for videotape copying, and as a vision mixer which is also capable of performing a wide variety of visual effects — from complex wipes and fade/dissolves to picture-in-picture and chroma-key superimpositions, plus a highly stable freeze frame facility. All of which can be achieved from a compact, relatively easy to drive unit with an RRP less than $1500.

The secret is, of course, digital technology. At the heart of the VMX400 is an 8Mb (megabit) high speed digital dual-field frame store, with matching video A/D and D/A circuitry performing 8-bit sampling at 13.5MHz, conforming to the CCIR601 4:2:2 standard. This gives a stored active picture area of 720 pixels by 625 lines by 16 bits.

When the VMX400 is used as a TBC, the incoming video is stored into this digital frame store asynchronously ('as it comes'), and then read out again synchronously under the control of a highly stable master clock, so that it's re-stabilised in terms of timing. Alternatively when the VMX400 is used as a video mixer, the frame store is used as a way of genlocking one of the two video inputs against the other, so that the mixing circuitry can perform a full range of wipes, mixes and cuts without breakup. The diagram shows how it's done, with everything under the control of a microprocessor. When no input source is selected for analog channel B, its video level defaults to black and digitised channel A is synchronised to the stable internal clock, to function as a TBC.

There are two video input channels, each of which can accept either composite or S-video (Y/C). Similarly there are both composite and S-video outputs. Needless to say for best results in terms of bandwidth/resolution, you need to use the S-video inputs; here you can achieve 7MHz/600 lines through the analog B channel, and 5.5MHz/500 lines through the digitised A channel. Using the composite inputs brings these figures down to 3.2MHz/250 lines for both channels.

As a mixer, the VMX400 naturally allows you to do excellent fades and lap dissolves. But that's really only the start, because there's also a choice of 60 different wipe and masking effects, each of which can have adjustable mask colour and be provided with hard or soft edges. And like the fades and dissolves, these can all be done either manually or automatically, at a choice of 10 dif-



One of the VMX400's video channels is digitised and passed through a digital frame store. This allows it to be resynchronised in TBC mode, or locked to the other channel for mixing and other video effects.

ferent speeds between 0.5 and nine seconds.

As mentioned earlier there's also a PIP (picture-in-picture) facility, with five different PIP sizes, adjustable position and programmable border and border colour. Then there's the chroma-key and luma-key effects, which allow you to replace a selected colour area in the A channel video with video from the B channel, for superimposition effects. The key colour can be set by 'sampling' from the displayed A image; you can also key on Y+C, Y only, C only or Y+C with a blue bias, and the keying threshold is adjustable in 16 steps.

The freeze-frame facility applies to channel A, and gives you a choice of either 'Normal' or 'High Definition' modes. The latter gives you a fully interlaced image, for highest quality, but can give you an irritating flicker if the video you 'froze' was changing significantly between the two stored fields. Presumably Normal mode overcomes this by using only one of the fields...

TBC functions

As a TBC, the VMX400 allows you to resynchronise the video signal fed through channel A, to virtually broadcast standards. Here again it also offers a range of special features, mainly to adjust the details of locking onto the incoming video signal — to allow processing of relatively 'sick' signals. There's a choice of four sync lock modes, two colour lock modes, either fast or slow colour lock time constants, colour subcarrier either locked to the mains or free running, and either normal or B&W locked.

There's also the ability to adjust brightness, contrast and colour saturation, to selectively invert the luminance, chrominance or both, and the ability to digitally enhance the detail for either composite or S-video inputs.

Then there are two special facilities for use in cleaning up tape copies where there has been significant colour timing problems. Here you can alter the timing of the chrominance information relative to the luminance, both horizontally in eight 100ns steps (from -4 to +3), and vertically in four steps of integral lines (0 - 3).

In short, it's a very flexible unit, and capable of allowing users of domestic video gear to achieve a high degree of professionalism.

Trying one out

Thanks to the co-operation of Video Tech's Australian distributor Questronix, we were able to try out a sample VMX400 for a couple of weeks and put it through its paces, as both a video mixer and a TBC.

Frankly we found its facilities and performance most impressive, and as far as we could determine it comfortably met its specifications. It was certainly a pleasure to be able to achieve so many of the video effects available to professionals, so well and with an affordable and relatively easy to drive unit.

Our only real complaint is that the system used to select and adjust many of the VMX400's operating modes and facilities is a bit crude and fiddly, by modern standards. Essentially you have to look up a function code and select it to be visible in one of the two-digit LED displays, and then select the desired value (again looked up) using the second two-digit display. It's all a bit fiddly, especially if you need to adjust a number of functions and parameters; but there's a quick reference card to help, and you eventually get used to it.

Apart from this, though, it's a very good performer indeed. By the way, there's also a model VMX410 which virtually combines the VMX400 with a four-input stereo audio mixer, complete with LED VU meters. ❖

Video Tech VMX400

A combined digital video mixer and time-base corrector (TBC) for use with domestic VCRs, etc.

Good Points: High performance, good bandwidth/resolution, wide choice of video effects. Able to resynchronise a video signal to virtually broadcast standards, including differential adjustment of chrominance-luminance timing.

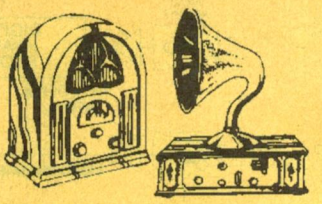
Bad Points: Selection of video functions and effects is rather fiddly.

RRP: $1499 including sales tax.

Available: Questronix, 2/1 Leonard Street, Hornsby 2077; phone (02) 9477 3596.

Vintage Radio

by ROGER JOHNSON



Taming the Autodyne

Although there were all-triode superhets during the 1920s, for all practical purposes the autodyne was the superhet of the 1930s. Understanding the basics of autodyne operation isn't too hard, but getting the most out such a set is more of an art than a science...

It is sometimes useful to explore the derivation of some of the technical terms used in a bygone age. 'Autodyne' comes from two Greek words: *autos*, meaning 'self', and *dunamis* meaning 'force', or 'work', hence an autodyne is a 'self working' superhet.

To get the maximum performance from one of these circuits, it is necessary to understand how they do 'work' (no pun intended).

The circuit in Fig.1 is typical of the many, many five-valve autodynes produced during the 1931 to 1935 period. It is actually reprinted from *Radio & Hobbies* for November 1943, where the late Neville Williams wrote a comprehensive article on keeping such sets alive and well during the war years (because there were no new radios available for the domestic market).

Every major manufacturer produced autodynes, and they fell into three main categories:

(a) The 1931/32 first series, using the five pin, 2.5V valves 224A, 235, 224A and 247 and 280 rectifier.

(b) The 1933/34 second series, using the six pin later series 2.5V valves 57, 58, 57, 2A5 or 59 and 80. During this period some manufacturers opted for the Philips 4.0V 'gold series' E446, E445 or E447, E444N or E446, and E443H or E463 output. Occasionally, the type 2A6 or a similar Philips variety was used for diode detection.

(c) The last series of 1934/35, using the 6.3V pre-octal valves 6C6, 6D6, 74, 42 and 80. Not infrequently a 6C6 was used as an anode bend detector.

Invariably the first and second series used a 175kHz intermediate frequency or thereabouts, and therefore had a three-gang tuning capacitor with a 'pre-selector', or bandpass tuning to improve selectivity and reduce or eliminate double spotting. The last series used the more conventional 465kHz IF and had the conventional two-gang tuning capacitor. There were some exceptions to the above classifications, but they were generally true for the vast majority of sets.

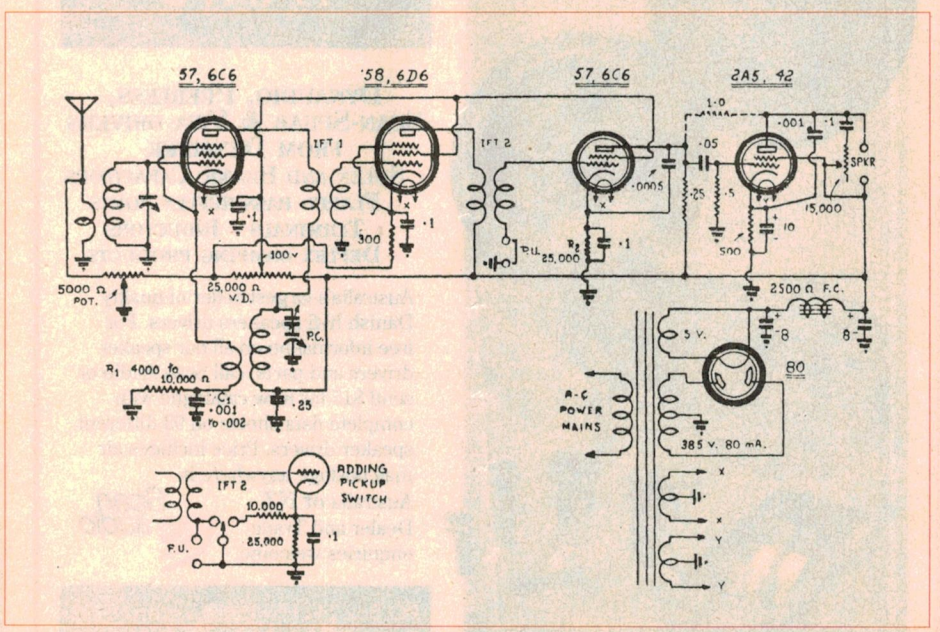


Fig.1: An autodyne circuit of the 1930s, as given in Radio & Hobbies for November 1943.

Local oscillator

The oscillator section is the heart of the autodyne. Whether it is anode tuned or cathode tuned, the primary of the first IF transformer is in series with the anode and either one of the windings of the oscillator coil, as appropriate. For the moment the IFT can be ignored, but its importance cannot be overlooked and there will be more discussion further in the text.

For the purposes of oscillation and the oscillator frequency, the first valve is working in grounded-grid mode. Instead of the cathode being at ground (or bias) potential, and the signal being applied to the grid, the grid is quite effectively earthed via the tuning winding of the main tuning coil. The oscillations are established between anode and cathode.

Crucial components

The cathode resistor R1 and capacitor C1 are an important part of the oscillatory circuit, and serve the function of oscillator 'grid' capacitor and its associated 'grid leak' resistor in a more conventional circuit. However, the DC conditions of the valve must be taken into account, as R1 also provides the cathode bias. If there is much variation in these components, the valve may fail to oscillate. Therefore, in a receiver which is not working and all of the coils are intact and the valve is good, replacement of these components within the range suggested may well prove beneficial.

Of the dozens of these circuits that have been examined, there has been practically no, if any, deviation of the values as shown in the circuit diagrams.

Cathode tuning

The earlier autodynes generally employed the oscillator circuit as shown in Fig.2. Here, the oscillator coil winding in the anode circuit is the 'tickler', and the tuning coil is in the cathode circuit. In other words, the windings were reversed.

The one variation is that the cathode resistor and capacitor are tapped down the tuning coil. The texts seem to be devoid of an explanation for this practice, but a likely reason may have been to prevent too much of the oscillator voltage appearing at the cathode and causing problems with the valve's operating characteristics, or causing problems with mixing. Again, the resistor and capacitor form part of the oscillator circuit as well as providing DC bias to the valve.

It is said that the plate-tuned circuit was preferable. Possibly a plausible reason was to prevent the intermediate frequency being in turn coupled to the tuning coil and hence being fed back into the valve, thereby causing stability problems. The 'tickler' winding would be of low impedance at intermediate frequencies — all the more so at 175kHz.

In each case, the oscillator frequency is determined by the section of the tuning gang connected across the main section of the oscillator coil, as shown in the diagrams. The series-connected padder capacitor (PC) is used to achieve tracking — i.e., oscillation at a frequency spaced away from the input by an amount equal to the IF (usually on the high side).

The signal input, tuned by the first gang section, appears between grid and cathode in the normal sense for an RF pentode. Resistor R1 in these circumstances only serves to provide DC bias to the valve.

Thus, we have the valve receiving a tuned signal input to the grid, and an oscillator circuit in the cathode. These two signals are mixed in the same manner as a conventional mixer.

The first IFT

When we come to the first IF transformer, there is a major departure from the superhets using a heptode or triode-hexode frequency converter (6A7, 6A8-G, AK1, AK2 etc). As the primary of the first IFT is in series with the oscillator coil, its inductance acts as an RF choke.

Usually, an IFT's internal compression trimmer, or the fixed capacitor in later years, was 50-70pF, and the inductance chosen to match the given IF. However, if that were the case with the autodyne, the inductance could well be large enough, and therefore offer sufficient impedance, to prevent the coil and the valve from oscillating.

Therefore, to suit autodynes, engineers designed a first-IFT with a high C/low L ratio in the primary. Usually the capacitor was about 150pF. The subsequent IFT windings have no effect on oscillator performance, and are of conventional design.

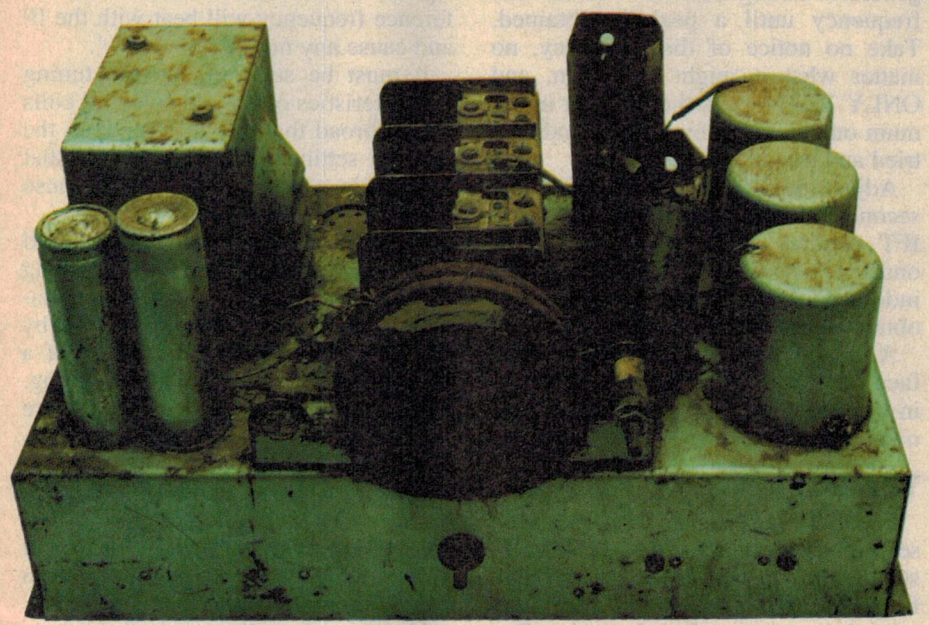


Fig.4: A typical early autodyne chassis, made by 'Eclipse' and in this case straight from the maison-de-chook and awaiting a sympathetic restoration...

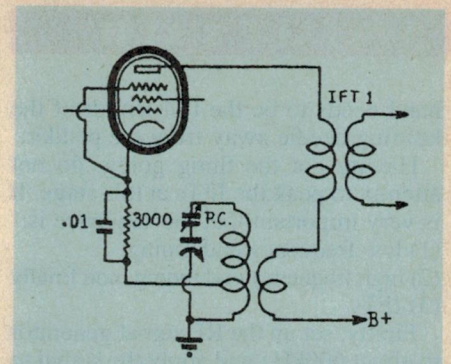


Fig.2: The connections for the alternative cathode-tuned autodyne oscillator, also taken from R&H for November 1943.

Alignment — 465kHz IF

The alignment of these sets is where science gives way to art! First and foremost, you will need a suitable tool to adjust the padder. Modern, slim tools designed for modern small components are useless; you'll need something more sturdy.

Firstly, apply a minute amount of penetrating oil via a pin or a sewing needle to the thread of the padder adjusting screw, and ensure that it turns freely. Next, go to grandma's knitting bag and pinch one of those big fat plastic knitting needles about 6 - 7mm thick, and with a file, fashion a screwdriver blade at the free end.

This is important. Whether the padder is in the plate circuit of the cathode circuit, it will suffer considerably from hand-capacity effects and de-tune if a metal screwdriver blade is used. Your

hand needs to be the full length of the knitting needle away from the padder.

Having got the thing going, do not attempt to peak the IFTs at this stage. It is very important that the sequence is:
(1) low frequency end tuning;
(2) high frequency end tuning; and finally
(3) IFTs.

Firstly, set up the RF signal generator to about 600kHz and apply the signal to the antenna terminal. With the volume full on, and the generator output suitably attenuated, adjust the tuning gang and padder for maximum output. There will be a spot on the dial where a given combination of tuning gang setting together with padder adjustment will provide maximum output.

It is not merely a matter of setting the tuning gang to an approximate position and then adjusting the padder to suit. These things have a mind of their own, and there will be an optimum setting of gang and padder adjustment...

In some locations, there are stations at the very low frequency end of the dial. Examples are 5UV Adelaide at 531kHz and 3WV in the Wimmera at 594kHz. With a superhet of later design, it may be possible to tune down to those stations with no noticeable deterioration in performance. However, with an old autodyne, you can forget it. Any attempt to tune down that low will seriously disrupt performance at the high frequency end.

Next, tune the generator to about 1500kHz and repeat the process by rocking the gang and adjusting the trimmers (on the tuning gang). A point will be usually found where the output is again noticeably higher than any other setting. Again, don't try for those stations right up at 1600kHz if it won't tune that high. Attempts to reach those frequencies may cause image problems

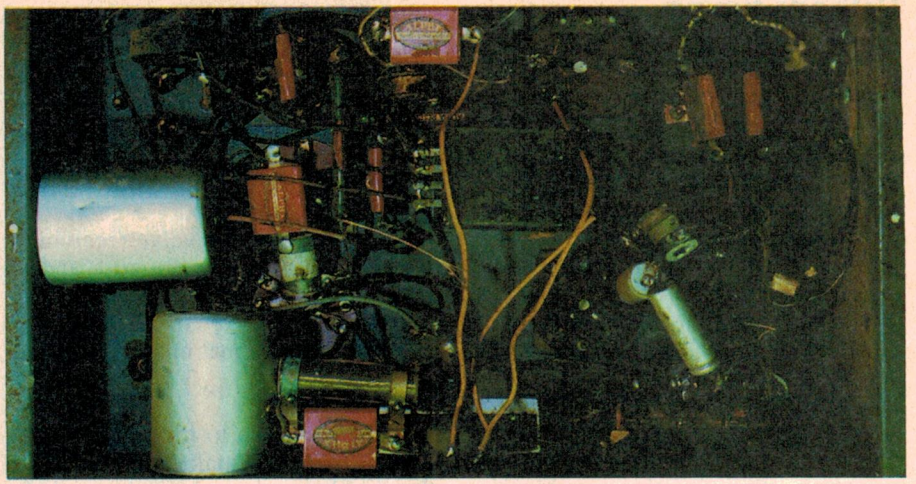


Fig.5: Underneath the chook-house special. The two cans are for the oscillator coil and first IFT, which are inter-connected.

further down the dial!

Lastly, with the generator connected to the grid of the mixer, and WITHOUT touching the trimmers, gently rock the generator tuning near the intermediate frequency until a peak is obtained. Take no notice of the frequency, no matter what it might be! Then, and ONLY THEN, peak the IFTs for maximum output, again by using grandma's tried and true alignment tool.

Adjust the secondaries first, then the second IFT primary, and then the first IFT primary. The second IFT secondary in particular will be very flat indeed, and a peak may be difficult to obtain, so try that again last of all.

Although the foregoing flies in the face of conventional wisdom, the IFTs in these sets also have a mind of their own! They have a 'preferred' setting.

The real fun...

For those unfortunate to have an old set with a pre-selector and a 175kHz IF, start with step (1) above. At the high frequency end, all sorts of problems can arise. It is a matter of mathematics. One of the tuning coils could easily be tuned to say 1500kHz, and the other, by an inappropriate setting of its trimmer, be tuned to either 1675 or 1325. The difference, is of course, the IF. If these two signals are fed into the mixer, the difference frequency will beat with the IF and cause any number of 'joeys'.

It must be stressed that the tuning characteristics of the old solenoid coils are so broad that any difference in the relative settings of the two coils that are within coo-ee of the IF will cause the problems described.

The solution is patience, trial and error. If joeys are present, try removing the signal generator and using a local station or stations, try and tune them out by adjusting each trimmer a fraction of a turn and gently rocking the tuning gang.

Having satisfied yourself that there are no spurious oscillations, try connecting the generator again tuned to about 1500kHz, and repeat (2) above as for the 460kHz IF. Remember, adjust the trimmers only a fraction of a turn at a time. NOW you can peak the IFTs in the manner described.

If you are really keen, the whole process can be repeated, particularly peaking the IFTs. But keep in mind only undertaking FRACTIONAL adjustment of padder and trimmers, otherwise the whole alignment can be easily be thrown out.

It must be stressed this is *not* a five-minute job. The best part of an hour can be spent setting up one of these sets, especially one of the early pre-selectors.

Having said that, they do perform reasonably well given the limitations of the tuning range and lack of AGC. A full treatise on detection, volume control and other quirks and peculiarities of these sets are discussed in *Radio & Hobbies* for November 1943, April 1944 and October 1944. ❖

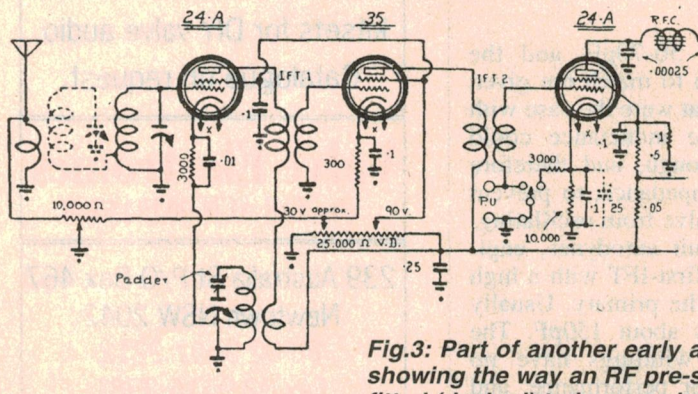
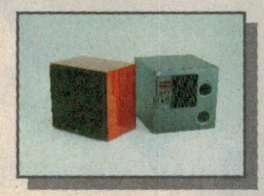
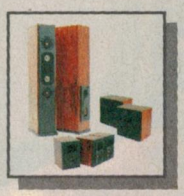
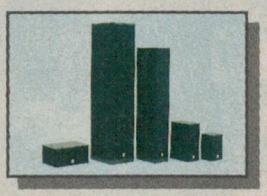


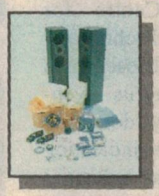
Fig.3: Part of another early autodyne circuit, showing the way an RF pre-selector coil was fitted (dashed) to improve image rejection.

So You Don't Like To Compromise...









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TESTING THE WATERS

Wouldn't it be great if your GP could test to see if those chest pains *were* a heart attack, right in the surgery? Or test your blood for a range of specific ailments, in a few minutes flat? Such developments may be much closer than you think, thanks to a revolutionary biosensor device which has been developed by a team of scientists in Sydney.

by GEOFF McNAMARA

It's small, it's cheap, it gives reliable results quickly, and it can save patients lots of money, even their lives. Sound too good to be true? Well hang on, because this is the Ion Channel Switch Biosensor (ICS Biosensor), a device that is about to revolutionise diagnostic testing in environments ranging from blood streams to water streams. Not only that, the technology the ICS Biosensor is based on has been described by experts in the field as being perhaps the next wave in microsensor technology, a revolution that could rival the microprocessor in terms of size, scale and impact.

And where is this miracle machine made? Why, here in Australia, of course!

The device was developed by scientists at the Cooperative Research Centre for Molecular Engineering and Technology (CRCMET) in Sydney. The ICS Biosensor is a platform technology which, say its inventors, is capable of accurately detecting minute quantities of substances indicating the presence of everything from industrial pollution to the occurrence of a heart attack. In fact they claim that the range of applications is only limited by imagination.

Biosensors aren't new. Diabetics and the police have been using sophisticated biosensors to check sugar and alcohol levels for years. But these instruments are severely limited, and usually only able to detect one substance at a time.

Until now, the alternative was to send samples away to a pathology laboratory where they can be subjected to a wide range of tests. The problem with this method, however, is time — and time can be a critical factor. Take, for example, a patient who suspects they are having a heart attack: chest pains and aching shoulder. The problem is that neither the patient nor the doctors at the local outpatients' ward can be certain. The ECG looks normal, but just to be sure the patient is put into a hospital bed. Basing their judgement on years of training and experience, the doctors decide to administer expensive drugs in case the heart attack is real.

Using the ICS Biosensor technology, the above scenario would be entirely different. Not only does it give virtually instant, on-site results; it allows you to test for a variety of substances simultaneously. Potentially thousands of them...

Testing the operation of the ICS Biosensor at the Australian Membrane and Biotechnology Research Institute (AMBRI) in Sydney.

A nanomachine

You see, the ICS Biosensor is a 'nanomachine' — an instrument constructed and operated at the molecular level — and so can be incorporated into instruments which are small and robust. This means that while the ICS Biosensor is remarkably sensitive, quick, and reliable, it can also be taken into the field where it can produce immediate results.

In the heart attack scenario, a nurse could analyse a drop of your blood for levels of several key proteins and enzymes. The results — available in a matter of minutes — indicate whether or not you are having a heart attack. If you are, treatment can begin and your body's response to the drugs is checked in real time via more drops of blood using the same instrument.

The technology which underlies the biosensor came from Australian expertise in

implantable electronics, following inventions such as the pacemaker and the bionic ear. By combining the technology from many disciplines, scientists have created a device that reacts chemically with the substance you're searching for and, when it finds it, produces a measurable electrical signal.

Central to the ICS Biosensor is the ability to create nanomachines. The desire to reduce the size of instruments is well known and understood. The semiconductor industry, for example, has maintained the diminution of chips for decades. According to Owen Hill, an engineer now in charge of administration and nanofabrication at the CRCMET, so far efforts have relied on 'top-down' manufacturing: "Manufacturing has been dictated by taking a chunk of something and reducing it to an item we can use." An example is the manufacture of a lens, where a lump of glass is ground and polished to a specific shape.

"A different school of thought is to build things molecule by molecule", Hill continued, pointing out that 'bottom-up' manufacturing simply mimics nature. For example, while lens grinding is a labour-intensive and expensive exercise for us, "nature achieves the same thing with a drop of water on a leaf!"

Despite the fact that when nature builds things they don't look all that 'perfect' — trees and rivers aren't perfectly straight, for example — the myriad of nature's products (including humans) seem to work, and often extremely well. So the question arises, why don't we do things the way nature does?

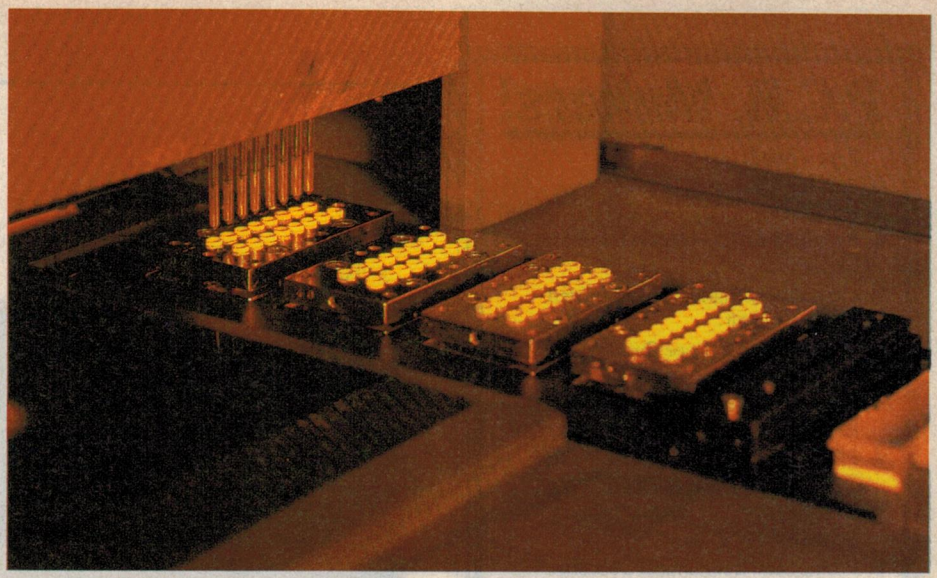
The ICS Biosensor is constructed according to this new approach. Using 'molecular self-assembly', the scientists select the molecules they want to do the job and, by judiciously applying them one after the other, let them assemble themselves into the biosensor.

How it works

So how does the ICS Biosensor work? It reveals the presence of the substance you're looking for, called an 'analyte', by monitoring a tiny electrical current. When the analyte is not present in the sample you're testing the current remains constant. When the analyte is present in the test sample it alters the flow of electricity in the biosensor. This change can be detected and analysed to reveal the presence of the analyte.

The current through the biosensor doesn't depend on a flow of electrons, however. "Central to the biosensor technology is the recognition that the signalling system (in the body) is not electronic, it is ion transfer", Hill explained. The creators of the ICS Biosensor followed nature's lead. "We have perfected a way of controlling and modulating the flow of ions in the biosensor", Hill continued.

The component of the biosensor that permits this is a molecular 'slide-switch' that varies its electrical — that is, ionic — conductivity depending on the presence of analytes. At the base of the switch is a fine-gold base overlaid with an ion reservoir. Above this is a special molecular membrane made from two layers, one on top of the other. The lower half of the membrane is fixed to the gold base by long-chain molecules. The upper half floats on top of the lower half, its molecules constantly moving about due to thermal motion. The test sample — a drop of blood, river water, or whatever — is placed on top of the upper layer of the membrane.



Nanofabrication of prototype ICS Biosensors at the Cooperative Research Centre for Molecular Engineering and Technology (CRCMET) in Sydney.

Built into the two layers of the membrane are molecules of 'gramicidin', a naturally occurring molecule that ions can flow through like liquid through a drinking straw. As the top layer floats around over the bottom layer, the gramicidin 'ion channels' in the upper layer will occasionally line up with those in the lower layer forming a molecular conduit called a 'dimer'. When a dimer is formed, it allows ions to flow across the two layers down to the ion reservoir. Electrodes placed in contact with the gold base and the test solution permit the measurement of this flow and hence the impedance of the membrane. Ordinarily, this alignment is random and so the impedance properties of the biosensor are constant and well known.

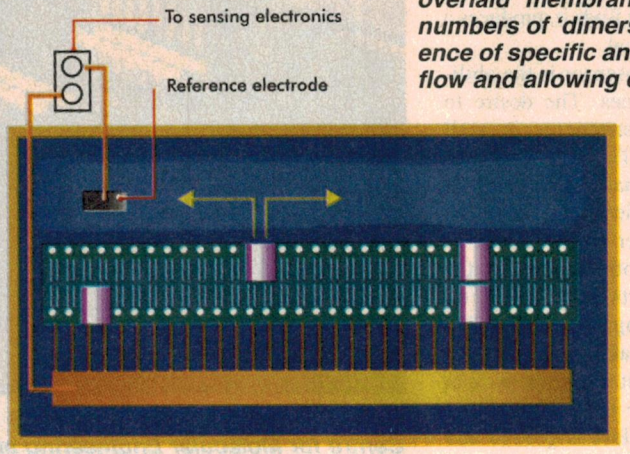
During a test, a drop of whatever you're testing is placed in contact with the upper layer. If the analytes are present in the sample it either increases or decreases the number of dimers formed, depending on the type of molecule you're searching for. This changes the rate at which ions flow and so changes the resistance of the membrane.

There are three ways the biosensor can be used to detect substances. One is called a 'cross-linked assay' which is used to detect larger molecules. This method uses the fact that when the target analyte is present, it prevents the gramicidin molecules in the upper and lower layers of the membrane from lining up. This reduces the flow of ions, increasing the impedance of the layer.

In the 'competitive assay', the biosensor detects analytes by increasing ion flow. The flow of ions is initially and deliberately inhibited by tethering the gramicidin molecules in the upper layer, so preventing them from wandering about and linking up with those in the lower channel. When the test sample is introduced, analytes react with the gramicidin molecules in the upper layer, freeing them to wander around in search of partners in the lower layer. When they find partners they form dimers, the ions begin to flow, and the impedance falls.

A third method (which has yet to be exploited) involves special molecules called 'ion carriers' that can travel across the membrane. Ion carriers can be made so that they are attracted to specific ions that cannot ordinarily get through the membrane. When a sample containing the target analyte is introduced to the top layer, the ion carriers grab hold of them and carry them across the membrane. The ion carriers deposit their passengers on the other side and then dutifully return to the top layer again.

The biosensor can be understood in terms of an electrical circuit. By applying alternating potentials over a range of frequencies, it is possible to measure the relative capacitance and resistance of different parts of the biosensor. For example, when the gramicidin ion channels form dimers they conduct an electrical current. When no dimers are formed, a charge builds up in the top layer, and so it behaves as a capacitor. Due to the nature of the membrane, there is always some leakage of ions through the layer, and so the layer can be described in terms of resistance. Finally, ions can also accumulate at the electrode, resulting in a phenomenon called 'interfacial capacitance'.



Molecules of 'gramicidin' in a pair of overlaid membranes cause increased numbers of 'dimers' to form in the presence of specific analytes, increasing ion flow and allowing electronic detection.

Impedance plot

By monitoring the conductivity of the layer, the user can determine the presence of the analyte using a technique called 'impedance spectroscopy'. In a pure resistor the impedance is constant over all frequencies, whereas in a pure capacitor, the admittance (reciprocal of impedance) is proportional to frequency. These characteristics can be plotted on a Bode plot, a graph which compares impedance with frequency. The impedance varies with frequency depending on the response of the different parts of the biosensor to the electrical potential.

Since the different components of the biosensor respond in different and characteristic ways, the optimum point can be found for monitoring the behaviour of different parts of the biosensor. This behaviour depends, of course, on the presence of the target molecules.

Impedance spectroscopy allows the user to monitor the impedance properties of the biosensor at a specific frequency. When the sample is added to the biosensor, changes in the impedance of the slide switch give away the presence of the analyte almost immediately.

One of the major advantages of the biosensor is the fact that, like chemistries occurring in nature, it is amazingly selective: it only detects the target analyte and ignores hundreds of other chemistries in the same solution. This 'molecular recognition' means the biosensor is very reliable. In each case the transfer, or lack, of ions can be detected and measured. Importantly, the number of ions making it across the membrane is proportional to the quantity of the analyte in the solution.

But this doesn't mean that the biosensor can only search for one thing at a time. While other types of biosensor have been around for years they are limited to detecting one thing at a time, such as the levels of insulin in a diabetic's blood. Hill observes that the electronics industry has been scoffing at the chemists for years, saying things like "Why is this the only biosensor you guys have made? These things must work in other areas too."

The way pathology is done now means that if a doctor asks for a specific test, say cholesterol, then that and only that test will be carried out. What the scientists have done is to create a generic mechanism that can be geared to detect several specific molecules simultaneously. Already it is feasible to put several different chemistries on a single chip, but the potential is there to create a device that targets hundreds, perhaps thousands, of pathologies in a single drop of blood. This will improve on a major drawback of current pathology techniques.

The ICS Biosensor has already attracted interest from a number of potential buyers, including the water board and the US military (for detection of biological weapons use), as well as the obvious medical applications. Hill says the device should be produced commercially within the next 12 months. If the critics are right, however, this is only the beginning, and we are likely to see applications of this technology no one has ever dreamed possible.

Internet site

Anyone interested in the details of how the ICS Biosensor works, or how it's put together, should go to the Australian Membrane and Biotechnology Research Institute pages at **http://www.ambri.com.au/institute/technology/index_content.html**.

Geoff McNamara is a freelance science writer based in Sydney, and a frequent contributor to Electronics Australia. ❖

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READER INFO NO.7

PC-driven communications receiver:

ICOM'S IC-PCR1000

In contrast with most modern communications receivers and their bewildering array of front panel controls, the Icom IC-PCR1000 is an unassuming little 'black box' with only one control: an on-off switch. That's because the receiver uses a PC for its main user interface — with the matching software even giving you a choice of three different on-screen 'front panels' to suit users at different levels of technical sophistication. The performance is also very impressive, and belies the set's modest physical appearance...

by JIM ROWE

Using a PC to provide the 'user interface' for a communications receiver makes a great deal of sense, because a lot of the complexity and cost of a modern comms receiver is tied up in the user interface. Front-panel controls and display hardware tend to be the most expensive components nowadays, quite apart from the circuitry needed to look after them. In fact most of today's conventional comms receivers have at least one inbuilt microcontroller just to look after the front panel...

How much more sensible, then, to offload all of this user interface responsibility to a PC running suitable software. Most people using serious comms receivers nowadays are going to be using a PC anyway, so the resource will be readily available.

The basic concept isn't new, of course. One approach has been to build the remaining 'guts' of the receiver proper into a PCB card, to plug directly into the PC itself. This saves even the cost of a separate case and power supply; there is a catch, though. The inside of a PC is hardly a friendly environment for a sensitive communications receiver, with all kinds of high frequency and relatively high-energy digital signals racing around. It takes a huge amount of design effort to achieve good signal-to-noise and spurious signal rejection performance — although it has certainly been done, and quite successfully.

Icom has taken a different tack with its latest IC-PCR1000 comms receiver, though, choosing to keep the receiver quite separate as a self-contained 'black box' which is hooked up to the PC via a standard RS-232C serial port. So it can be seen as a kind of extension of the facility built into many of Icom's conventional comms receivers, which can be controlled remotely from a PC using either the CI-V or RS-232C serial interfaces. With those receivers the PC can be used as an alternative 'remote front panel'; in a sense all they've done with the IC-PCR1000 is to drop the hardware front panel altogether, so that the PC takes over completely.

Having the receiver still in a separate external box must surely make things a good deal easier for the hardware designers, too. Rather than being transplanted into the unfriendly environment of a PC, the receiver proper is still in its own box — and now with even less accompanying digital circuitry than before.

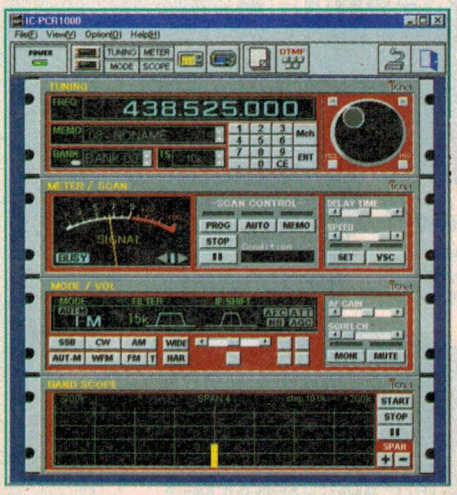
Icom has also been quick to realise that once you take this approach, there's a major advantage in terms of user interface flexibility. Since your receiver ends up with a 'virtual' front panel, its user interface and control facilities can be tailored relatively easily for different applications. In effect, the one receiver can be made to behave as a number of different 'models', simply by running different software front panel emulations.

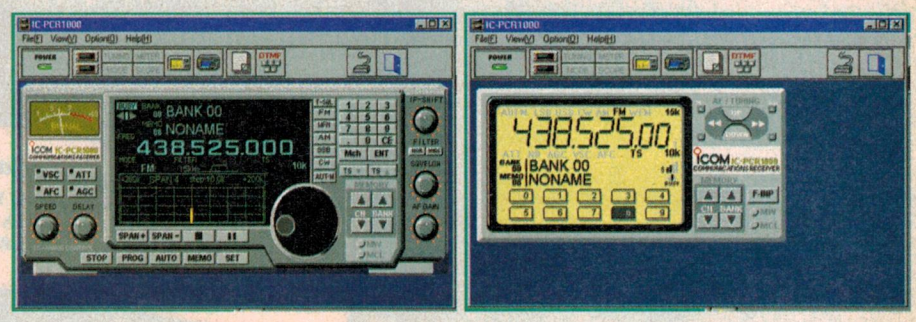
So with the IC-PCR1000, for example, they've been able to provide the matching Windows 95/Win 3.1 software with a choice of *three* different virtual front panels configurations:

- A 'component' front panel, where the receiver assumes the guise of a professional rack-type system with separate panel modules for tuning, metering and scanning control, receiving mode/filtering/volume control and a panoramic-type 'band scope';
- A self-contained comms receiver emulation, with all of the usual controls and looking like one of Icom's conventional high-end receivers; and
- A less intimidating 'radio/scanner' emulation, to offer a more friendly guise for the casual or less technical user.

In each case the receiver's front-panel controls are easily and intuitively manipulated using the PC's mouse, and the status easily seen from the screen display. Each receiver 'personality' even has its own online help facilities. All of the usual facilities of a modern comms receiver are available in each case, of course.

How about the actual receiver itself? Well, the IC-PCR1000 is a wide range LF/MF/HF/VHF/UHF receiver, tuning continuously from 10kHz to 1300MHz — although the full specifications are only guar-





Icom's driver software for the IC-PCR1000 provides a choice of three alternative 'virtual front panels' — a rack-type professional receiver (L), a standard communications receiver (centre) or a radio/scanner (R).

The receiver unit itself is an unassuming 'black box', which links to your PC via an RS-232C cable.

anteed from 500kHz up. It provides AM, FM, WFM, SSB and CW reception modes, and is essentially a triple-conversion superhet in most modes and over most of the frequency range. The first IF is at 266.7MHz, the second at 10.7MHz and the last at 450kHz (with this last not used for WFM).

There's a choice of five basic selectivity characteristics, with bandwidths of 230kHz, 50kHz, 15kHz, 6kHz and 2.8kHz respectively between -6dB points. Not all of these are available in each reception mode, of course; they're available as appropriate. For example only the two widest bandwidths are available for WFM, and the two narrowest for SSB and CW. But AM mode provides a choice of the four narrower settings, while FM provides the three mid-range choices.

Rated typical sensitivity in SSB/CW mode (2.8kHz passband) for 10dB S/N is 0.56uV between 500kHz and 1.8MHz, 0.28uV from 1.8MHz to 30MHz, 0.35uV between 30MHz and 50MHz, 0.2uV between 50MHz and 700MHz and 0.25uV above 700MHz. Minimum frequency resolution is rated as 1Hz, while the rated frequency stability at 1300MHz is +/-3ppm (0 - +50°C).

Needless to say there's a wide range of selectable tuning steps, plus the usual array of scanning modes and memory facilities (like 20 banks of 50 memory channels). Other nice features of the receiver include an IF filter shift facility, able to shift the IF filtering up or down by more than 1.2kHz to minimise interference from adjoining signals; and the real-time 'band scope' facility, which shows you graphically the signals on either side of that currently being received (over a range of up to +/-200kHz).

The hardware side of the IC-PCR1000 consists of a compact and literal black box, measuring 199 x 128 x 30mm and weighing only 1kg. It's powered from 13.8V DC, drawing around 700mA maximum, and comes complete with a suitable plug-pack power supply — along with all matching cables, the software and a small telescopic indoor antenna. A small speaker is inbuilt, but there's also provision for an external speaker (or alternatively sending the audio at line level to a PC's sound card, and hence to its audio system). There's also a digital output, to allow demodulated packet radio data to be fed to a TNC (terminal note controller).

On the front of the box there's only the on-off switch, as mentioned earlier. All of the I/O connectors are along the rear panel: the packet radio output, a DB9 socket for the RS-232C line to the computer, the external speaker/line output socket, the DC input socket, an earthing terminal and a BNC socket for the antenna input.

Trying it out

Icom Australia very kindly sent us an IC-PCR1000 for review, and I elected to try it out with my recently acquired HP Vectra PC using a 266MHz Pentium II. Although that machine runs Windows NT4 and the receiver's software is only specified as suitable for either Windows 95 or 3.1, I decided to 'give it a try' because most Win95 software will also run on NT4.

The punt worked, and Icom's software installed very quickly and painlessly from the two 1.4MB floppies supplied. I soon had the receiver running nicely, and was able to spend the next few days putting it through its paces.

I must say I wasn't too impressed by IC-PCR1000's Instruction Manual, though. It's a lot thinner than previous Icom manuals, and seems to assume that you'll get everything else you need from the software's on-line help system. But I didn't find that especially helpful, either...

As you'd expect the small telescopic antenna supplied is scarcely sufficient to achieve anything like the receiver's full potential. In short order I hooked it up to my usual antennas (a fairly long balanced dipole for the HF bands, and a discone for VHF/UHF), and found the performance much more impressive.

I also checked the receiver out with the test instruments, and found that its measured performance compared very well with the specs. FM sensitivity for 12dB SINAD was below 0.4uV between 30MHz and 990MHz, for example. There were very few 'birdies', too — Icom seems to have done an excellent job of keeping computer RFI out of the receiver.

On the whole, then, and based both on measurements and using the receiver over a wide range of bands, I found the IC-PCR1000 an impressive performer. Not in the ranks of top-end comms receivers, to be sure, but certainly comparable with previous general purpose models like the IC-R71/72 on the HF bands, and the IC-R100 on the VHF/UHF bands. It offers good solid performance — and of course offers additional features and facilities as well. Like the choice of virtual front panels, and the convenience of driving it from a PC.

At $899.38 the price is also pretty attractive, presumably because you're no longer paying for a fancy hardware front panel. Well, not when you're buying the receiver itself, anyway... ❖

Icom IC-PCR 1000

A PC-driven wideband communications receiver, covering 10kHz - 1300MHz. Triple superhet design, offering all standard reception modes.

Good points: Good solid performer as a general purpose receiver. Very easily operated from the PC; offers a choice of three alternative 'virtual front panels'. Well shielded against RFI from the computer.

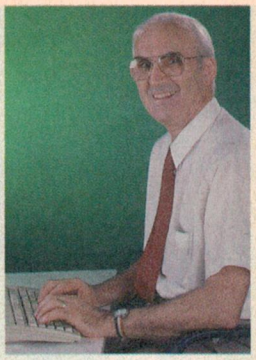
Bad points: Instruction manual fairly superficial, on-line help system not especially helpful either.

RRP: $899.38

Available: Icom dealers. For your nearest dealer ring Icom Australia toll free on 1800 338 915.

FORUM

Conducted by Jim Rowe



Those electrotherapy devices: starting to sort through the deluge...

As promised, here's a follow-up to the discussion in our January and February columns about 'alternative electrotherapy' devices — partly to answer some of the criticisms that have been directed my way, and partly to correct a few misunderstandings about what I was trying to achieve in those columns. I'm also presenting for your consideration some information on one of the more credible examples of these controversial devices, from US researcher Dr Robert C. Beck.

It's a bit hard to know just where to *start* with this month's column. As I mentioned in last month's leader, I was almost buried in reader feedback following the January column. Even though there was much less from the February column I've still had an enormous pile of letters, faxes, emails, audio tapes and even a couple of videotapes to wade through. And as if that wasn't enough, a lot of the 'primary' correspondence has also offered a string of internet-URL addresses where I've been directed to find supporting 'secondary' reference material...

Sorting through it all hasn't been easy, especially as many of the people who responded seem to have been so affronted by my daring to criticise their favourite alternative therapy device, that their missive often amounted to little more than an angry venting of their spleen in my general direction. I've been accused of almost everything from being an intolerant and stupid fool with a closed mind, to being clearly a paid apologist for supposed global cartels of wealthy pharmaceutical firms — with a vested interest in suppressing any attempts by innocent alternative medicine people to provide low-cost (and hence minimal profit) ways to alleviate human suffering.

You can't do much about this sort of criticism, of course. I've been in this modest little backwater of the media long enough to realise that if you express *anything* very much, even in a magazine as venerable and innocent as *EA*, there will always be some people who are upset as a result. I've also been on the receiving end of this sort of angry missive often enough to know that such people often become quite insulting in a personal sense, and that there's generally almost nothing you can say or do to alter their convictions.

What I do *try* to do, though, is look beyond the invective — to see if there's something positive and informative that the person concerned may be providing me with, not always intentionally. I suppose this is an attempt to act on the old Socratic idea that 'He who can show me where I've fallen into error, does me a great service'.

It isn't always easy to achieve this, of course, especially when one's own ego gets in the way as it often does. Just like our correspondents, I'm all too human myself in that respect.

Where I went wrong...

But enough preamble. Where did I perhaps go wrong, in the January column in particular?

Well, in my discussion of 'Zapper' devices (of the type based on the work of Dr Hulda Clark), I probably fell into the trap of assuming that if a device appears to be extremely simple and cheap, it must therefore be 'shonky' and by definition incapable of performing the function claimed. Many of my critics accused me of this, and I have to agree that in this they're quite right — it's *not* a valid assumption. Simplicity and low cost do not in themselves preclude a device from performing a claimed function; in fact some of the best solutions to problems have often turned out to be so simple that one looks at them in amazement, marvelling that they weren't discovered sooner.

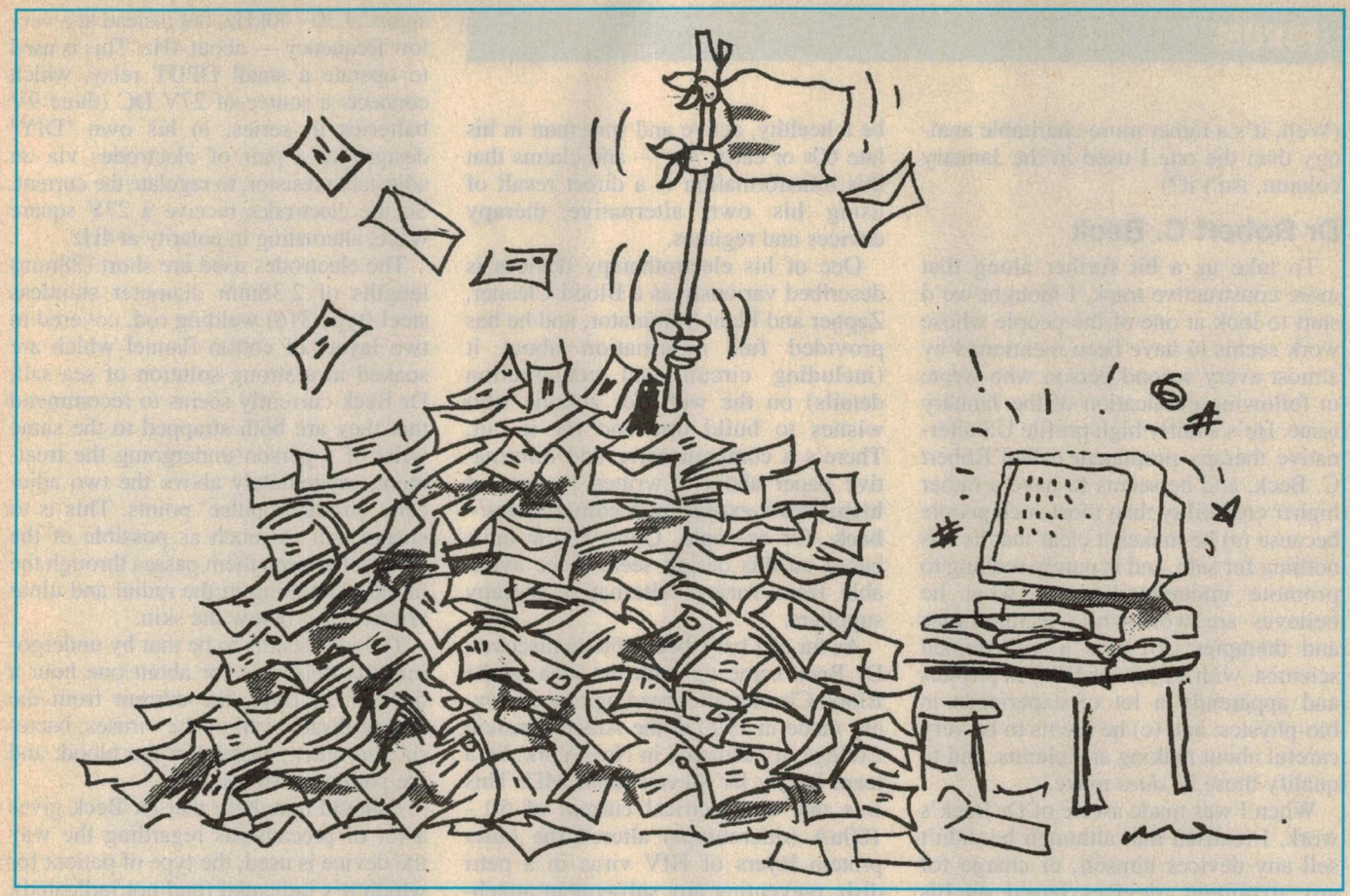
But of course the other side of the same argument is that simplicity (real or apparent) and low cost aren't in themselves a guarantee that such a device *does* perform the claimed function, either. So in many ways these qualities are a red herring, and irrelevant to the question of whether the devices in question work or not.

Another assumption I've been accused of making is that because some of the 'alternative electrotherapy' devices seem overpriced, or have unbelievable claims made for them, and others are sold in crudely modified packaging from other companies, then *all* of the people promoting and marketing these devices must necessarily be unscrupulous charlatans, preying on ill and desperate people. That's obviously not true either, of course — and although I wasn't trying to suggest that it was, perhaps some of my comments may have suggested otherwise.

Perhaps I should add here, by way of explanation, that from the considerable further information I've been able to consider since writing the January and February columns, I'm quite prepared to believe that quite a few of the people promoting these alternative electrotherapy devices are acting from the highest of motives. Indeed some seem to be quite altruistic and driven by a genuine desire to help alleviate suffering — essentially by providing information for people to 'help themselves', rather than selling them anything.

That's not to say that I'm necessarily convinced that what they're claiming is valid, of course. That very much remains to be seen. But it's certainly not correct to assume that they're all crooks.

Mind you, in admitting that I seemed to be making unwarranted assumptions about the 'alternative therapists', I'm also aware that most of my critics seemed to feel perfectly justified in making even more damning assumptions about the motives and ethics of traditional medicos and pharmaceutical



companies. I lost count of the number of angry readers who accused virtually all doctors of being purely profit driven, and essentially uninterested in 'curing' any illnesses because it would supposedly rob them of their livelihood. Just about all of them made similar scathing accusations about the big global pharmaceutical companies, and were convinced that they actively and ruthlessly suppressed any discoveries that threatened their profits. But presumably it's quite OK to make *these* sorts of assumptions and accusations...

I may also have been wrong in implying, or seeming to imply, that suppliers of these 'alternative' electrotherapy devices are collectively all rather glad that Australia's Therapeutic Goods Administration (TGA) seems to be currently unable or unwilling to test the efficacy of their devices — on the presumed basis that this allows them to 'sneak them through' and dupe unsuspecting consumers.

I'm pretty sure that there *are* people who think this way, but I'm now inclined to think that at least *some* people in the alternative electrotherapy area would probably welcome the opportunity to have their devices and theories taken seriously, and tested thoroughly by medical and scientific authorities. That way, they wouldn't have to rely on their own convictions and limited anecdotal evidence, in convincing people of their value.

One more area where I probably went astray in January was in latching onto those books of Dr Clark's, with their worryingly immodest titles like *The Cure For All Diseases* and *The Cure For All Cancers*. She's apparently well known for her gung-ho approach, and apparently even some of her supporters find this a bit embarrassing — because they realise that it must inevitable weaken her credibility. But they still claim that she acts from the highest of motives, and has some ideas that are well worth being taken seriously. I don't know about that, but I agree that it was a cheap shot to damn her work sight unseen, on such a superficial basis.

A closed mind?

And that brings me to the last main criticism that was levelled at me after the January column: that like so many people in traditional medicine and science (supposedly), I have a 'closed mind', and have so convinced myself about the impossibility of any 'alternative therapy' device working, that I'm not even prepared to consider any of them objectively. As a result, say the critics, I'm quite prepared to ignore and/or dismiss devices and therapies which have been shown to offer real help to seriously ill people...

Could that be true? I certainly hope not, because I agree with the critics that this would be wrong. It's always hard (perhaps even impossible) to judge one's own behaviour objectively, but I do consciously try to be as objective and 'open minded' as I can. It seems to me that objectivity is a worthwhile goal, even if it's almost impossible for we humans to achieve it fully.

Anyway, I hope the above explanations clear the air a little. What it all seems to boil down to is that although the alternative electrotherapy area does seem to have more than its fair share of unscrupulous people and dubious devices, we shouldn't fall into the trap of assuming they're all con artists flogging snake oil and spouting bunkum. That would be making the same mistakes as many of *them* seem to, in damning all medicos and drug companies...

Let's all try to stay calm and as objective as we can, in other words, and see if there *are* any gems hiding in that big mountain of somewhat confusing 'ore'.

(Well, it's a rather more charitable analogy than the one I used in the January column, isn't it?)

Dr Robert C. Beck

To take us a bit further along that more constructive track, I thought we'd start to look at one of the people whose work seems to have been mentioned by almost every second person who wrote in following publication of the January issue. He's a fairly high profile US alternative therapy proponent called Robert C. Beck, and he seems to have a rather higher credibility than most such people because (a) he makes it clear that he has nothing for sale, and is purely seeking to promote understanding of what he believes are worthwhile technologies and therapies; (b) he's a well-trained scientist, with a PhD (or DSc) in physics and apparently a lot of experience in bio-physics; and (c) he seems to be very careful about making any claims, and to qualify those he *does* make.

When I was made aware of Dr Beck's work, I realised that although he didn't sell any devices himself, or charge for any treatment, devices based on his work and endorsed/authorised by him seem to be offered by various firms in the US and elsewhere. So I tried to contact him through one of those firms, Sota Instruments Inc (whose web site is at **http://www.sota-inc.com**). The attempt turned out to be unsuccessful, though, as it appears that Sota and Dr Beck were 'warned' about me by one of their local distributors — Natural Therapy Products of Turramurra NSW, one of the firms whose products I mentioned in the February column...

So I haven't been able to check any of the following with Dr Beck himself. It's all gleaned from various sources, including stuff on the web, some off-web disk files and a videotape of a Dr Beck talk sent by Darryl Jones of Newcastle in NSW, and an audiotape of another talk by Dr Beck sent by Les Banki of Springvale in Victoria. My grateful thanks to both of these readers for their assistance.

I haven't been able to learn how Dr Beck got into the alternative health area, but he seems to have had fairly severe health problems himself. At one stage he apparently weighed 285 pounds and was confined to a wheelchair with high blood pressure and a very high blood sugar level. Judging from the videotape sent by Darryl Jones, he now seems to be a healthy, active and spry man in his late 60s or early 70s — and claims that this transformation is a direct result of using his own alternative therapy devices and regimes.

One of his electrotherapy devices is described variously as a Blood Cleaner, Zapper and Plant Stimulator, and he has provided full information about it (including circuit and construction details) on the web, for anyone who wishes to build one and try it out. There's a comprehensive and informative paper about it written by him at **http://www.explorepub.com/articles/-beck**, for example. Quite a few units based on this design seem to be available from various alternative therapy suppliers.

As far as I have been able to discover, Dr Beck came up with the idea of the Blood Cleaner after reading of a discovery made in 1990 at the Albert Einstein College of Medicine in New York, by a team led by Dr Steven Kaali MD. This was that an electrical current of 50 - 100uA (microamps) altered the outer protein layers of HIV virus in a petri dish, preventing any subsequent attachment of the virus to 'receptor sites'. In other words, that the HIV virus could be effectively disabled by a weak current.

Granted US patent

Dr Kaali and his team went on to develop this idea for use in 'cleaning' blood out of the body — i.e., at blood banks, during transfusions and so on. They discovered that their process rendered not only the HIV virus ineffective, but also had the same effect on virtually any virus, bacterium, fungus or parasite in the blood. This was such a dramatic result that they were able to obtain a patent: US Patent number 5,188,738, dated February 23, 1993, which you can find on the web (it's public information) at **http://www.patents.ibm.com**, and also at **http://aps.cnidr.org**.

Of course the Kaali team's approach to 'cleaning' someone's blood involves taking it out of the body, which involves a relatively expensive and risky procedure. Dr Beck decided that he might be able to achieve the same end much more simply and safely, in a sick person, by leaving the blood inside them and treating it 'in vivo'.

What he came up with is a low cost device, based like Dr Hulda Clark's Zapper on a common 555 timer chip. However this time it doesn't generate a signal at 30 - 40kHz, but instead at a very low frequency — about 4Hz. This is used to operate a small DPDT relay, which connects a source of 27V DC (three 9V batteries in series, in his own 'DIY' design) to a pair of electrodes via an adjustable resistor, to regulate the current. So the electrodes receive a 27V square wave, alternating in polarity at 4Hz.

The electrodes used are short (28mm) lengths of 2.38mm diameter stainless steel (type 316) welding rod, covered in two layers of cotton flannel which are soaked in a strong solution of sea salt. Dr Beck currently seems to recommend that they are both strapped to the same wrist of a person undergoing the treatment, immediately above the two adjacent 'strongest pulse' points. This is to ensure that as much as possible of the current between them passes through the blood circulating in the radial and ulnar arteries, just below the skin.

The idea seems to be that by undergoing this treatment for about one hour a day for 21 days, the current from the device disables all of the viruses, bacteria and other 'nasties' in the blood, and the patient recovers...

I should note here that Dr Beck gives a lot of precautions regarding the way the device is used, the type of patient for which it's indicated (and not indicated), the need to drink lots of water (in order to help flush away the 'dead bugs'), the foods that shouldn't be consumed during treatment, and so on. So the above very brief description shouldn't be used as a basis for action — anyone proposing to try using a Beck-type Blood Cleaner should read all of his explanatory material first, at the very least.

It appears that there is quite a lot of anecdotal-type evidence suggesting that Dr Beck's Blood Cleaner can achieve quite dramatic results, in terms of what traditional medicos call 'spontaneous remissions'. He himself is so convinced of its efficacy (especially when used in conjunction with other treatment) that he apparently spends much of his time working with a medical research team in the San Diego area, carrying out a patient study which he and his supporters hope could convince the American FDA (Food & Drug Administration) that it should be given official approval.

But that's all we have space for this month. Next time, I'll try to give more details (including the circuit) of Dr Beck's Blood Cleaner, and perhaps also talk about his other devices, the 'Magnetic Pulse Generator' and the 'Brain Tuner'. I hope you'll join me, in exploring this somewhat unfamiliar world of alternative electromedicine. ❖

Experimenting with Electronics

by DARREN YATES, B.Sc.

Voltage converters

This month, we start looking at voltage converter circuits — which take a single voltage source, usually positive, and make higher positive or negative voltages from it.

The circuits we've been looking at over the last few months have been growing steadily in their complexity and while that's a natural progression you'd expect, it makes it hard for beginners to just come in at any time. So this month, I'd like to revisit some good old transistor technology and look at voltage converters.

When I just started out in electronics, I was looking through some old magazines and books and came across circuits that if you put a low voltage in at one end, you got a higher voltage out at the other end. That may not sound like a big deal, but when you're limited to however many batteries you can link together as your power supply, voltage converter circuits were like winning lotto. Well, I thought so at the time...

While many converter circuits are designed to produce mains voltage from say a car battery, I don't propose to look at anything that isn't suitable for our younger readers.

All of these circuits can be operated from batteries and are safe if built according to the circuit in the manner prescribed.

Supply splitter

The first circuit is about as simple as it gets and is ideal for projects where you need positive and negative supply rails, but you want to run the whole thing from just a single battery. Although this circuit uses an operational amplifier (commonly known as an 'op-amp') chip rather than transistors, it's very simple to get going and is quite cheap.

In fact, most of this circuit is smoke and mirrors — and that's not far from the truth. While you shouldn't get any smoke, there is some mirroring happening...

The circuit relies on the fact that the op-amp has a low impedance output, meaning it can source or sink a reasonable amount of current — about 20mA. As you can imagine from this, the circuit isn't quite going to run your CD player; but for small battery-operated circuits, it can be well worth a look.

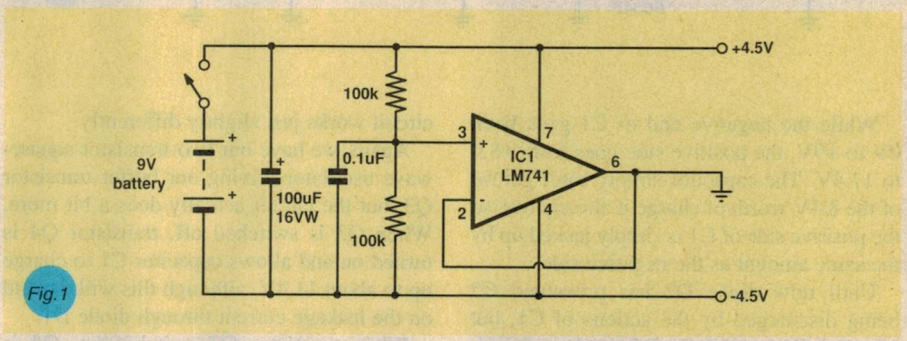


Fig.1

Looking at Fig.1, the op-amp is connected as a buffer with full negative feedback provided by the connection from the output to the inverting input. With the non-inverting input biased at half the supply rail via the two 100kΩ resistors, the output too is sitting at half the supply rail.

This half-supply rail point at the output can now be used as a pseudo-ground, giving you half the battery supply voltage as positive and the other half as negative.

The only 'but' with this circuit is that it should not be used to connect up to non-battery operated circuits.

If the circuit you're supplying uses other op-amps, you could use a dual or quad op-amp package and still do the whole thing with just one IC.

The LM741 works well, but for lower battery voltages, use either the LM324 quad package or the LM358 dual op-amp IC. These two ICs work down to 3V supply.

The circuit can also be adjusted for situations where you may need unequal positive and negative rails. For example, if you need a +6V and -3V rail, you replace the lower 100kΩ resistor with a 51kΩ type.

Voltage doubler

While the last circuit didn't really change any voltages much, this next circuit clearly gives us a boost in voltage. It's not terribly efficient, nor will it handle large currents, but if you measure the output voltage with your multimeter, you'll clearly see that you've got more volts at the output than you started with.

The circuit in Fig.2 is built around a simple two-transistor squarewave oscillator. The frequency of the oscillator is not overly critical, so if you don't have the exact same values, it won't matter too much. What is more important is that you make sure that you observe all of the voltage ratings where indicated.

The signal output is taken from the collector of transistor Q2, buffered and inverted by transistor Q3 and then fed into a rather strange configuration using two capacitors and two diodes. This is commonly known as a 'charge pump', and works by relying on the fact that capacitors cannot instantaneously change their voltage.

When transistor Q3 is on and its collector voltage is low, capacitor C1 charges via diode D1 and Q3 up to about +8.4V. However, when Q3 switches off, the negative end of C1 suddenly goes from around 0V to nearly +9V. This is where the capacitor's inability to change quickly comes into play.

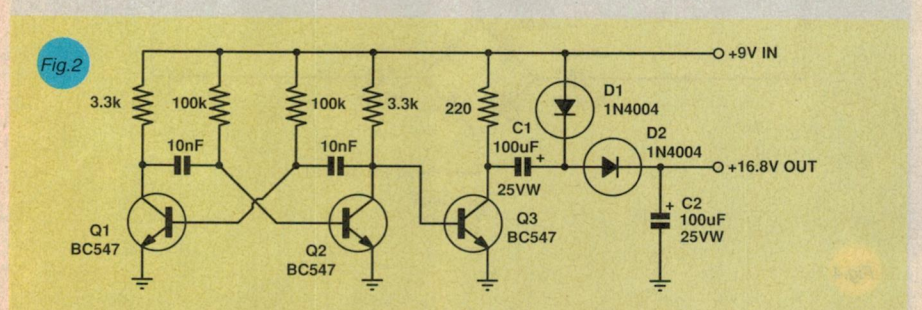


Fig.2

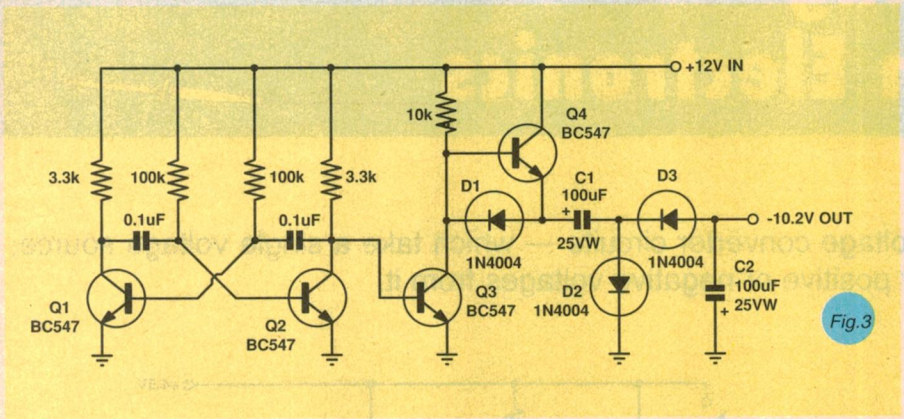


Fig.3

While the negative end of C1 goes from 0V to +9V, the positive side goes from +8.4 to 17.4V. The capacitor simply can't get rid of the 8.4V worth of charge it already has, so the positive side of C1 is simply jacked up by the same amount as the negative side.

Until now diode D2 has prevented C2 being discharged by the actions of C1, but now that C1 is at 17.4V, D2 conducts happily and C1 is discharged into C2 via diode D2.

If no current is taken from C2, it should reach a voltage of about +17.4V minus the forward drop across diode D2, which gives us a voltage of 16.8V — and remember, we've only got a +9V supply.

The more current you take from C2, the more capacitor C1 has to charge it up again. The overall effect is that the average voltage begins to drop. Pull too much current from C2, and all you'll be left with is a supply of about 8V — worse than when we started. The circuit is crude, but good for a few millamps anyway.

It's important that all the polarised capacitors be rated to at least 25V. The common 16V types will be straining at the seams.

There are some types of electrostatic microphones that require a high voltage at a tiny current. This sort of circuit, with more filtering would do the job well.

The 220Ω load resistor for Q3 plays a big part in just how much current this circuit will deliver.

If you need more current, you could reduce the value of this resistor but then you'd have to change transistor Q3 from a BC547 to a BC337, which is better equipped to handle the extra current flow.

A better alternative would be one of the circuits coming up.

Negative volts converter

The circuit in Fig.3 produces a negative supply from a 12V battery, using the same principles of the previous circuit.

Looking at the circuit, you can see we needed an extra transistor for this one and the circuit works just slightly differently.

Again, we have our two-transistor square-wave oscillator driving our buffer transistor Q3, but the circuit actually does a bit more. When Q3 is switched off, transistor Q4 is turned on and allows capacitor C1 to charge up to about 11.4V, although this will depend on the leakage current through diode D1.

When transistor Q3 switches on, Q4 is switched off and the positive side of C1 is pulled instantly from +11.4 to about +0.6V, thanks to diode D1 and Q3. This forces the negative side of C1 from +0.6V to -10.2V.

Capacitor C1 now discharges via the now forward-biased diode D3 into capacitor C2, and if no current is drawn from C2, it will charge up to -10.2V.

Again, the more current drawn from C2, the lower the average voltage it will have across it and the more the oscillator frequency ripple will be seen.

Because ground is still ground, it's OK to use these circuits with those driven from plug-pack power supplies.

You'll find this circuit of most use where you have op-amp circuits requiring positive and negative supplies.

For those more precise circuits, you'll need to add some more filtering to ensure that the negative supply this circuit produces is clean. Other than that, it should be good for at least 5mA.

One thing to watch: make sure you read the circuit carefully. That last capacitor has its positive terminal connected to ground — this is important, because you'll end up damaging the component if you connect it up the wrong way around.

More power...

The problem with these first voltage converters is that if you try to drag too much current from them, the voltage dies away quite quickly.

There are plenty of reasons for this, but the biggest is that the charge capacitor is only charged every second half-cycle, and for just half a cycle. If you look at the circuit in Fig.2, capacitor C2 is only charged when Q3 is off. When Q3 is on and capacitor C1 is being charged, C2 is just sitting twiddling its thumbs.

If we could use every half cycle, it would make quite a difference. That's exactly what the circuit does in Fig.4.

Note that we're now using signal from both sides of our transistor oscillator. The beauty of these signals is that they're automatically out of phase with each other, which means that if we correctly join them

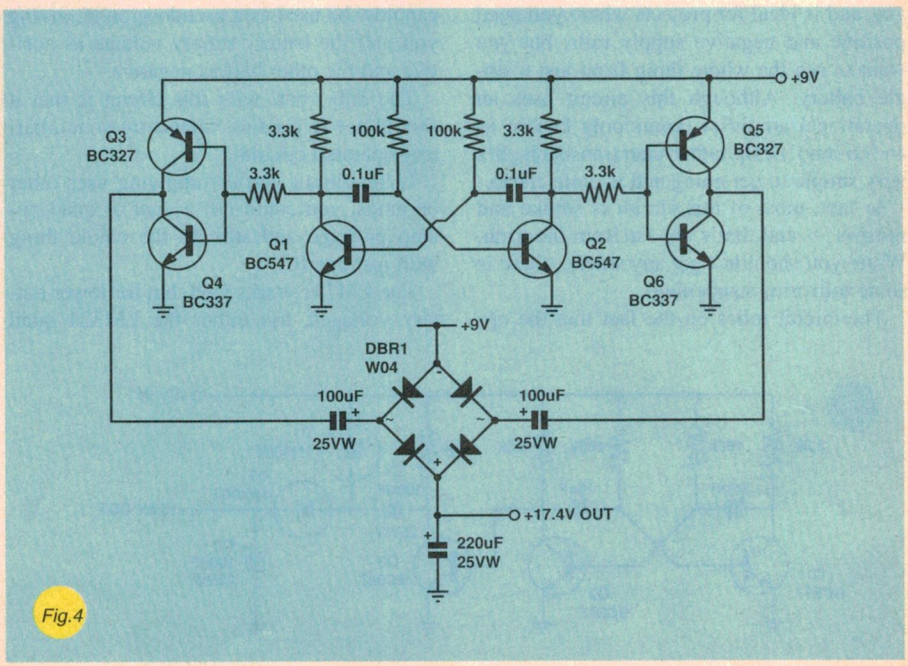


Fig.4

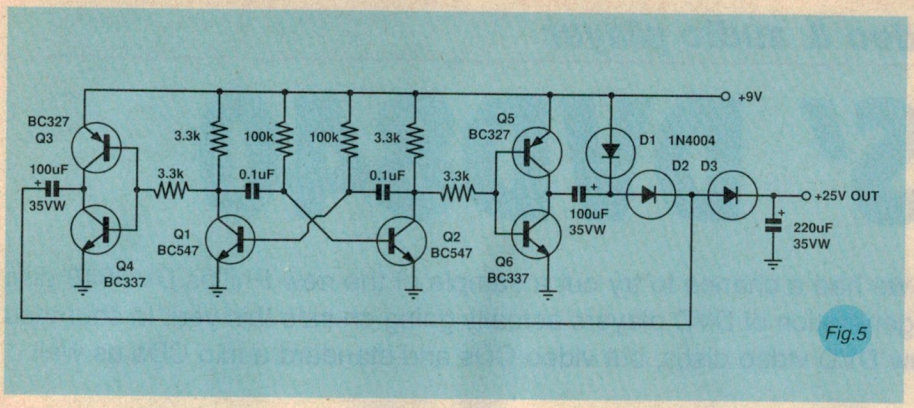


Fig.5

together, we actually get both halves of the circuit charging up the capacitor.

It's hard to describe, so the best way is for you to try it out for yourself. I've added in a buffer stage on each side of the oscillator (Q3-Q4, Q5-Q6), just to make sure that we don't load down the oscillator circuit to the point where it stops.

Normally you'd see the bases of the two coupled transistors in each buffer separated by biasing components, but as we're dealing primarily with digital signals, these components are not necessary here.

The buffers feed a full-wave bridge rectifier DBR1, which allows each half of the waveform to charge the 220uF output capacitor (via the 100uF capacitors) without allowing the charge to dissipate. The result is that you can pull more current from the circuit before the voltage starts to die, and the circuit isn't too much more difficult to build.

The full bridge rectifier is a component we haven't looked at before. It's simply four diodes connected together to form a bridge with four connection points. The one used here can be found in any Dick Smith Electronics store for about 50 cents.

Note too that we've used high-powered BC327 and BC337 transistors in the buffers. They have a top collector current rating of 1 amp — better than the 100mA of the BC547/557 series, and they're a better solution.

If you wish to use this circuit to power audio circuits, you'll need to add some low frequency filtering to remove the oscillator frequency from the supply rail. How clean the supply is will depend on the filtering you use.

Voltage tripler

The idea of using a switching frequency with opposite phases can be used most effectively for other voltage multipliers. This next circuit gives us a voltage tripler.

Because the voltages are starting to get quite high, I recommend you only use a 9V battery for this circuit.

Again this circuit in Fig.5 is very crude, but you should be able to connect up your digital voltmeter and see the output voltage hovering somewhere near the 25V mark.

In fact, the circuit is just a basic extension of Fig.2, and adds in a third diode and capacitor.

Voltage multipliers are used in TV sets and many other areas, but they can be extremely dangerous when the voltages get too high. They can turn the 240V AC mains voltage into HT voltages of several thousand volts.

25V is a safe enough level, but don't use a supply voltage of more than 9V and make sure you note the working voltage values of the electrolytic capacitors — they should all be rated at 1.5 times the circuit's output voltage, just to be safe.

Unless you're trained, stay away from mains voltages — I don't want to read about anyone frying themselves doing something silly.

Multimeters

Just a final word on multimeters. If you use a digital multimeter with these circuits, you'll find that you should get readings pretty close to what I've described.

If you use a traditional analog multimeter, you may find that your readings come up a bit short.

The reason is that digital multimeters have very high input impedances, upwards of 10MΩ, which don't load the circuit down. In contrast analog meters typically have impedances of only 20,000 ohms/volt. For the circuit in Figs.2 and 3, this might be enough to drop the circuit's output voltage a little.

In any event, it shows that while these early circuits do work, it doesn't take much to weigh them down.

I think it's always a good idea to have one of each type of multimeter on hand. For most jobs you can use the digital unit, but when it doubt, bring out the analog meter just to be sure.

Digital meters make most things quite easy, but they *can* give you misleading results, particularly in load-sensitive measurements. Batteries are a perfect example. Measure most partially-flat batteries with a digital meter and you'll find them measuring close to 1.5V, when their true working voltage could be as low as 1.2V.

OK, that's all for this month. Next time, we'll look at how to create voltage boosters and droppers using inductors. See you then. ❖

PHILIPS' DVD840

Just before this issue went to press, we had a chance to try out a sample of the new Philips DVD840 disc player — a good example of the first generation of DVD players actually going on sale this year in countries like Australia. It plays not only the new DVD video discs, but video CDs and standard audio CDs as well...

by JIM ROWE

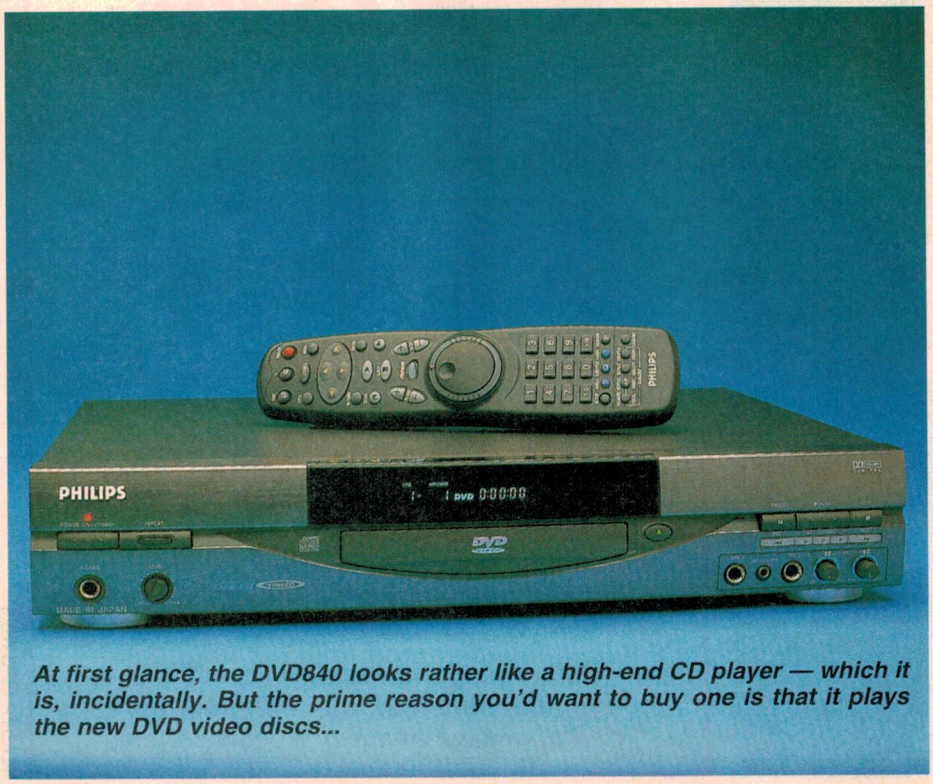
It finally looks as if DVD video discs and players are reaching the Australian market this year, after what seems like a frustratingly long gestation. (Louis Challis reviewed two pre-production DVD players back in our April and May 1997 issues.) This being the case, we were very interested to examine the new Philips DVD840 player.

Like most DVD players we've seen, the DVD840 looks rather like a high-end CD player. The first clue that it's capable of a lot more comes from the remote control, with some 43-odd buttons and a dual rotary 'jog/shuttle' type control knob. Then at the rear you notice the extra output sockets: composite video and S-Video outputs, *two* pairs of analog audio outputs and a digital audio output.

The fact is that the DVD840 will play not only standard audio CDs, but video CDs and the new DVD video discs as well — in the latter case, providing they're coded for either 'ALL' copyright regions or the region which includes your country. It even appears to play DVDs with video in either PAL or NTSC formats, again providing they're intended for your region...

Although the manual supplied with the review unit was rather vague, the player also seems able to play karaoke video CDs, and has a pair of microphone inputs (with gain controls) on the front panel. There's also a stereo phone jack for private listening, with its own volume control.

While the player itself doesn't include a digital surround sound decoder, its digital audio output apparently delivers a PCM/AC-3 bit stream suitable for connecting to the digital input (coaxial) of receivers fitted with either MPEG2 or AC-3 surround decoders. We didn't have such a decoder available when we tried the DVD840, so we listened to the sound in stereo.



At first glance, the DVD840 looks rather like a high-end CD player — which it is, incidentally. But the prime reason you'd want to buy one is that it plays the new DVD video discs...

The sample unit came with two demo DVDs and also a DVD with a feature movie: the Australian-made Academy Award winner *Priscilla, Queen of the Desert*. Although one demo disc was for 16:9 PAL format and other for 4:3 NTSC, both were marked 'ALL', so they were designed to play in all regions. The *Priscilla* disc was in PAL, as you'd expect, and clearly labelled for Region 4, which includes Australia and New Zealand.

When we hooked up the player to a late-model multistandard TV receiver and stereo system, it certainly gave a very good account of itself. The video from all three discs was very clean and crisp, with no discernable noise level and no evidence of the pixilation artifacts we've noticed on past DVD players, when there were any scratches or traces of dust on the discs.

In this case one of the demo discs even had a few small scratches, but they caused no obvious effects at all in terms of image quality. In all respects, the images were subjectively at least as good as from laserdisc, and often significantly better.

Much the same applies with the sound, which was subjectively just as good as from audio CDs. Very low noise and distortion, excellent frequency response and dynamic range, and virtually no trace of any 'pumping' due to digital processing.

The performance playing standard audio CDs was very impressive, as well. We gather that the DVD840 has two separate lens systems, one for DVDs and the other for CDs, to optimise performance in each case.

Despite the large number of controls on the remote, in practice the player was fairly easy to set up and drive via the on-screen menu system. Some of the setup options are fairly technical, though, and non-technical users might find them a bit bewildering — especially things like changing from analog stereo sound to digital MPEG2 surround sound mode, to suit the formats of different software.

All in all, though, we found the Philips DVD840 both an excellent performer in its

own right, and extremely good as a demonstration of the potential of current-production DVD technology for 'home cinema' entertainment.

Frankly, the performance of the DVD840 shows that DVD video is now fully debugged and market-ready. The image and sound quality are also so much better than domestic videotapes that you only have to experience it to want one. Which suggests that DVD video is indeed ready to 'take off' — as soon as there's enough reasonably priced software and players on the market. ❖

Philips DVD840

A DVD and CD player which plays the new DVD video discs as well as video CDs and standard audio CDs.

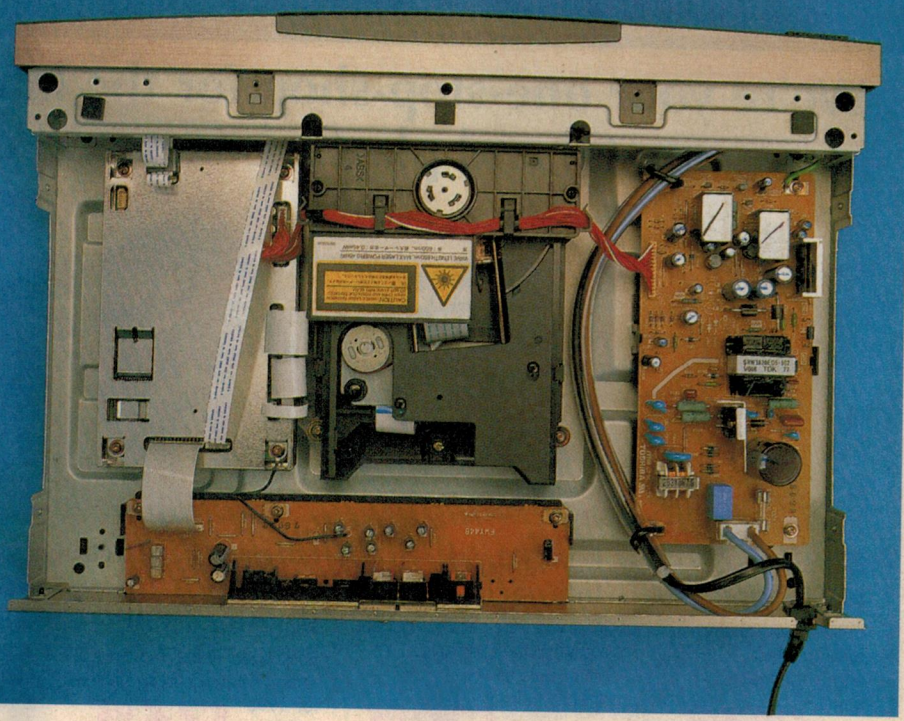
Good points: Delivers excellent image and sound quality from DVD video discs, seems relatively tolerant of dust and scratches on the discs. Compatible with audio and video CDs.

Bad points: Setup is a little complicated, especially for non-technical users. Not much software available as yet.

RRP: $1500.

Available: Philips Consumer Electronics dealers. For more information call the Philips Customer Service Centre on 1300 360 930.

Inside the DVD840 case. The disc player mechanism (centre) looks fairly standard, but again there's more than meets the eye: two separate optical systems, one optimised for DVD discs and the other for CDs.



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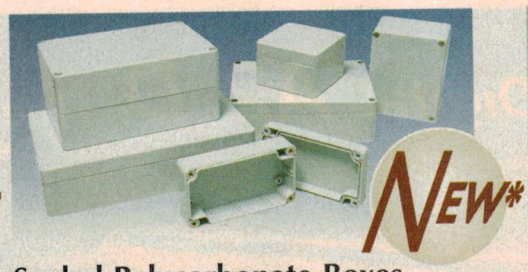

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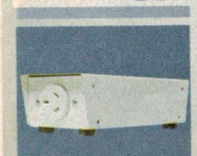

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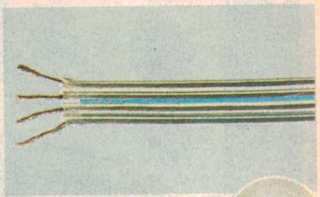

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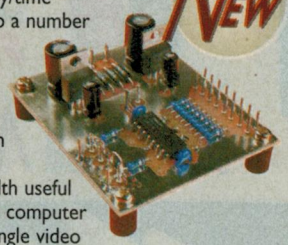

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- Good for home videos, allows professional post-production
- Fade out of one image and into the next, or wipe-out from one image to another, either horizontally or vertically
- Built-in enhancement facility to compensate for picture degradation caused by video dubbing
- Power source required: 12V DC
- Supplied with all components, hardware, sloping case, PCB power adaptor, and pre-punched screened front panel

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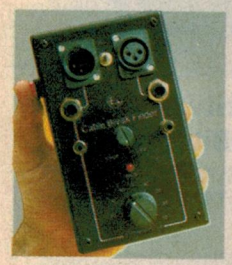

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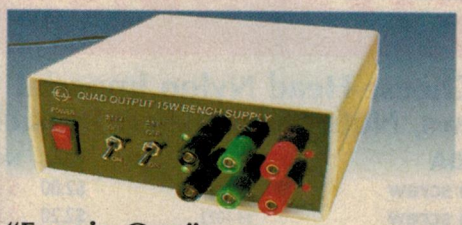

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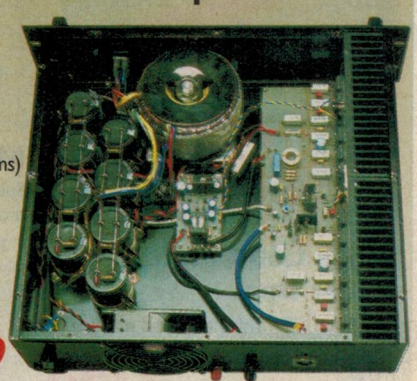

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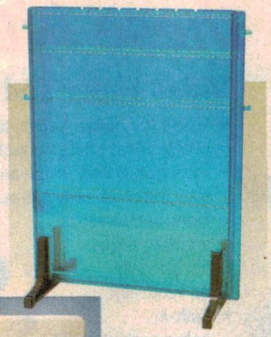

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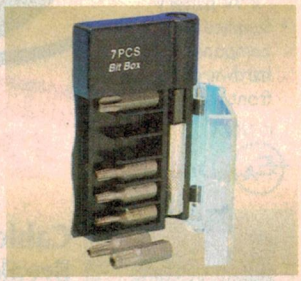

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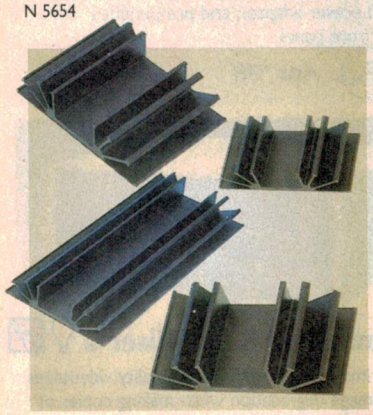

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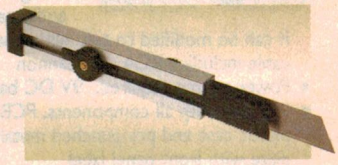

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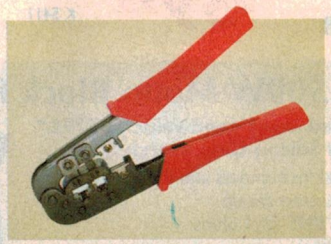

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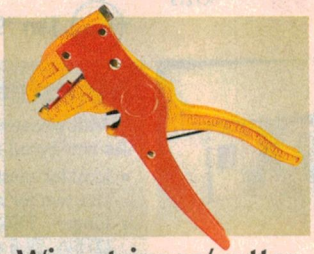

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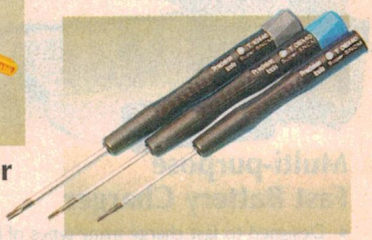

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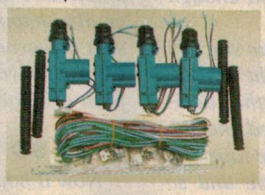

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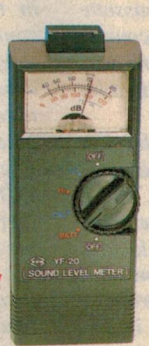

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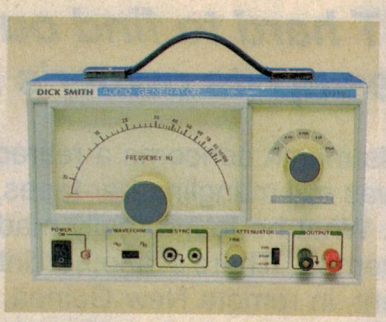

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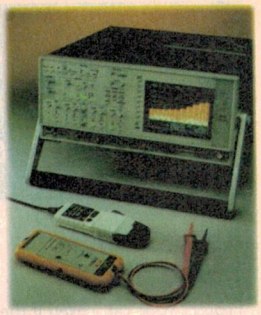


It simply isn't THAT hard to find out why a VCR munches up its owner's tapes!

One of our stories this month concerns a retired serviceman who was asked to find out why a friend's VCR was still mangling her tapes, despite having been 'repaired' by three previous technicians. What he found really made him wonder about the competence of the technicians concerned. There's another interesting story about having to make a home-brew component, in remote New Guinea, and finally a tale about a repaired VCR that seemed to be emitting a mysterious 'beeping' every night, at precisely 2:05am...

How many times should a product have to visit the service centre (or centres) before its fault is found and corrected? We've all heard of nightmare jobs that defy diagnosis, and eventually turn out to be the fault of some totally unexpected and apparently unrelated component. Then there is the other kind of story, which can only be attributed to incompetence among the several (or many) servicemen who have been entrusted with the repair.

This month's first story is one of the latter kind. It comes from Robert Abel, of Condobolin in NSW. You might recall that Robert wrote a month or two back about fixing an up-market audio tape recorder. This month he is 'into' VCRs.

He calls his story 'Different tapes', and it goes like this...

My adventures with the old Revox tape recorder seem to have spurred my interest in things electronic again. Anyway, for whatever reason I got tangled up with another tape machine, this time a VCR.

It happened as I was leaving a friend's place after a bit of a session with her computer (that's another story entirely), and she handed me a large black box and sundry cables, saying "That's the video I was telling you about — you might like to have a look at it".

Then I remembered having been told of the many visits this machine had made to the local service centre, at great cost each time but with little change in the continuing fault. This apparently consisted of the video tape getting tangled up inside, and more or less ruined. I think I'd probably said that it sounded like a problem that should be fixed without too much trouble, but didn't make any rash offers myself as my VCR experience was limited to occasionally programming my own machine — I finally closed my shop at the end of 1972, well before VCR's became common enough to need service.

As there was again a cassette stuck in the machine, my first thought was to remove it without causing further damage to the tape, so I removed the top cover. I could then see that the tape had not retracted into the cassette and so was hooked around parts of the tape transport mechanism.

I wound the tape back in by rotating one of the tape spindles, and then of course the eject mechanism could function to unload the cassette. The various bits seemed to move correctly and the cassette re-loaded OK, so I pressed 'Play' and — having previously connected up to a TV — picture and sound duly appeared.

Everything appeared normal, except where the tape had become flattened and creased while loose in the tape path. However, on pressing 'Stop', I could see that, for some reason, the retraction of the tape into the cassette was not being completed. So of course, any attempt to unload the cassette was going to do the exposed tape quite a lot of no good...

All of you VCR experts have by now worked out where the trouble lay; but remember, I knocked off in '72, and it took me a little longer to solve the problem. I reckoned I could see a lack of function in the idler assembly, but to be certain that I understood this properly — and all the other functions in this machine, I rang my favourite parts supply house. They specialise in VCR bits and yes, they had a service manual! So I ordered one.

I also got one of those clear plastic dummy cassettes that enable operation of the drive mechanism to be in plain sight. After a bit of study and a good look at the idler assembly, I determined that the clutch was worn out! I ordered a new assembly, which the parts supplier also happened to have (though they sent the wrong one the first time...), and when this was installed, the non-retract fault disappeared completely.

Why so long?

Now it had taken me a while to figure this out, but I was not even an amateur at VCR repair, so why hadn't the experts found such a simple fault the very first time up? I saw the last invoice, and there were pieces of packing tape stuck here and there inside the case, saying things like 'Low torque' and 'Replace drive electronics', so I know of at least three attempts — not that I could see anything that looked like a replacement.

Anyway, to complete the job and eliminate a slight hooking at the top of the picture, I bought that dual-trace CRO I had been drooling over for some time. My old one is a Heathkit — built in the 1960s, valve powered and of course, single trace!.

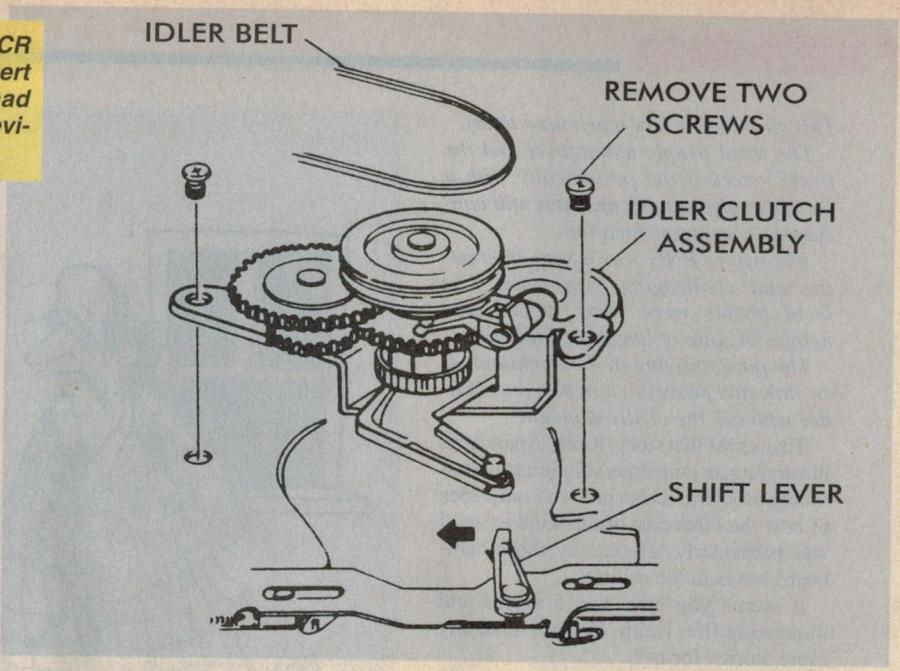
After I found out which bells and whistles responded to which controls, I used it (the new one!) to adjust the tape guides, etc., and check the other settings. So I learnt a bit more about VCR's along the way — including the fact that having a Service Manual for the right brand and model number does not necessarily mean that the machine layout will agree with the diagrams! (But then, what's new? I remember some old black and white TV manuals like that, don't I!)

When I returned the machine to my friend, I saw her new VCR in operation and I thought the old Akai was just as good, even if it has had the best years of its life!

But then, so have I! Happily, we can both still function quite satisfactorily!

As you seem to have discovered

The idler clutch assembly for the VCR tackled by retired serviceman Robert Abel. Very easily replaced, it had somehow escaped the notice of previous service tech's...



Robert, some 'servicemen' should not be allowed in the same town as a soldering iron. You are right in assuming that a competent technician would not have to think twice about a fault like this. It's so common, in so many brands and models, that it might be considered the serviceman's 'bread and butter'.

Most of us could knock over three or four of those jobs before lunch. Yet you seem to have found the one VCR that has stymied three or four, and possibly more, thoroughly incompetent servicemen. I only wish it was possible to alert their potential customers. The industry doesn't need that kind of operator.

Thanks for that story Robert, and I'm pleased to see you are still functioning satisfactorily. Keep it up.

Makeshift dropper

Now we come to a story from another recent contributor, Mr Keith Vieritz of Kalangur in Queensland. You might remember a month or two back we had a story by another contributor, from the remote heart of Irian Jaya. This month Keith gives us one from the remote heart of the country next door — Papua New Guinea.

Keith's story is quite a simple one, but one that exhibits a good dash of Aussie ingenuity, in the face of insuperable difficulties. Here's what Keith has to say...

I always enjoy reading your column. There are always a lot of interesting stories, some very unusual, but all with a lesson to be learnt.

Some years ago I went to Papua New Guinea with six other people to build a house at Telefomin, up in the Central Highlands. This house was to be a doctor's residence, so that Telefomin could have its own doctor, but plans were changed and we ended up repairing and painting an old house instead. This became the doctor's residence.

One day the Sister-In-Charge at the mission hospital asked me if I could connect up the light in a new microscope which had been donated to them. This would be a great asset in identifying the various diseases that the locals are plagued with, especially the various strains of malaria.

"Certainly, I could do that", I replied. So I was given a small brass bayonet lampholder and asked to connect a flex and three-pin plug to it, so that it could be run off the 240 volt supply whenever the diesel generator was running — which was only a few hours a day.

"You can't put 240 volts on that", I exclaimed. "Could I please see the lamp?" It was brought over from the hospital and turned out to be six volt, 15 watt type. It would have made a bright flash on 240 volts!

The hospital has an emergency lighting supply from a bank of 12 volt batteries. These are charged by the diesel when it is running. The best idea then would be to use this emergency supply, which is always on and there would therefore be no restriction on the use of the microscope.

But how do you drop 12V down to 6V, when you are many miles from any sort of town, and the only transport is by air? I had a look around the mission and found only a couple of junked radios. There was nothing in them that would make up 2.5 ohms and 15 watts.

Then I spotted a roll of galvanised iron tie wire. It would carry the 2.5 amps without any trouble, so I rolled out about five metres and measured its resistance — a bit over 1 ohm. So 10 metres could be about the right length...

I connected up the lamp to a 12 volt battery with 10 metres of tie wire in series, and trimmed it until I had 6V across the lamp. I now had the right value resistor, but it was a bit cumbersome. What do you do with 10 metres of tie wire in the doctor's office?

I found a piece of wood about 100 x 50 x 200mm and space-wound the wire over this, with a nail each end for terminations. This was connected in series with a lead to the microscope.

Next, I had to run a circuit from the battery bank to the doctor's office across the ceiling. The Sister told me to watch out for all the cardboard boxes in the ceiling — "they are our little coffins for the babies that don't make it".

The job was completed and the microscope went straight into service, checking blood samples for malaria. If a known strain is detected, the correct medication can be used to ensure the patient's recovery.

When I arrived back in Australia, I made up a small regulated power supply to deliver 6V at 2.5A and sent it up to Telefomin to replace my rather awkward home-made resistor.

As a matter of interest, the Telefomin air strip was built during WW2 by General McArthur's forces. A bulldozer was dismantled and the pieces flown into the jungle in large gliders. The parts were retrieved from the wrecked aircraft, the dozer reassembled and put to work clearing the trees for a landing strip.

This strip is still very much used today.

The local people maintain it and the RAAF check it out periodically with a Hercules aircraft, because it is still considered a strategic location.

The trip to PNG was a very interesting and challenging experience. The local people were very friendly and helpful in spite of language difficulties.

The pace of living in the Highlands is so slow and peaceful, it makes one wonder who are the civilised people.

Thanks for that story, Keith. Apart from illustrating an ingenious solution to a frustrating problem, it also gives us some idea of how the other part of mankind exists. I was particularly affected by those cardboard boxes in the ceiling.

It seems you have had a varied and interesting life, Keith. Do you have any more stories for us?

Beeps in the night

Now to our final story for this month, a salutary tale from Colin Golledge, of Mascot in NSW. Colin's story reminds us that you should never take for granted anything the customer says. Most customers haven't got a clue and will tell you anything that comes into their heads. Especially at 2.00am!

Here's what he has to say...

This was a National NV-600 VCR, but mind you, the fault I am about to describe can happen on any video or TV, of any brand, PAL, NTSC or Secam, anywhere in the world!

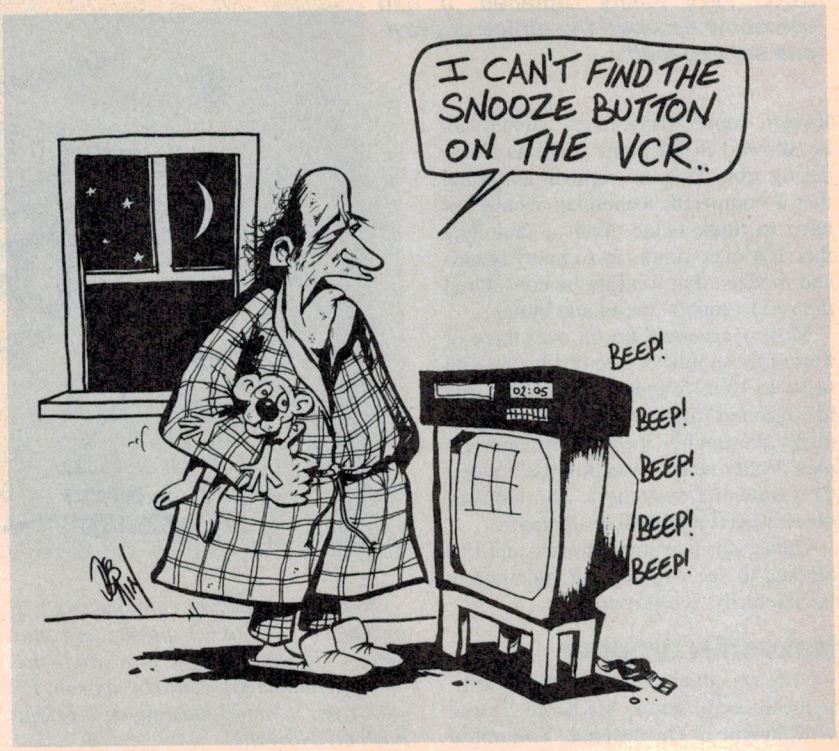
I was asked to do a house call by an elderly couple because their video was connected up to the stereo and satellite receiver, and they were worried they wouldn't know what to connect back to what. So I called and quickly diagnosed a worn video head, showed them how to label all the cables, then took the video back to the workshop.

The next morning I examined the video head with a magnifying glass and confirmed the head was definitely worn. So I gave them a quote for a new head and a set of belts, which they accepted.

That afternoon I changed the head and belts, cleaned the tape path, put my test tape in (colour bars) and it worked perfectly. I then tested it with my 'poor quality' tape, (a weak TV signal) and it played that perfectly as well. Two days later I was back in the customer's area, so I set it up for them, demonstrated that it was working properly and they were very happy.

I collected my fee, tipped my hat, and thought about having yet another happy customer; but alas! Two weeks later I got a phone call saying that the video kept making an odd noise.

The next day I was in the area, so I popped in and they described a beeping noise at 2:05am every morning. They insisted that it came from the video, and it had only been happening since I had fixed the machine.



"Oh, that must be the timer switch", I said confidently. But it wasn't. That switch was already off. I then checked the timer record memory, but there was only one 'on time' in memory and it didn't correspond to the time of the complaint.

The lady insisted that it was definitely the video making the noise, because she had got up one night and put her ear right up to it.

So I unplugged the video for a while, reset the time and said "It won't happen again". (I must stop saying this!) But a week later they rang saying it was still beeping at 2:05am. Could I visit again?

Two days later I was in the area and again they insisted that it was definitely the video, because they had both got up and checked that the noise was coming from the machine.

I then got the idea of advancing the video's clock to 2:04am and seeing what it did. Well, I advanced it and with baited breath we waited for 2:05am. But nothing happened!

I was fuming. Why wouldn't it happen when I was there? I certainly wasn't going to wait till the real 2:05am came round! In my ever-curious manner I was looking round the back of the machine for loose wires, wrong connections — anything to explain this 'phenomenon', when what did I spy but a child's digital watch.

I asked them what it was doing there, but they didn't know. I decided to check the alarm time and guess what, it was set for 2:05am!

Talk about egg on face and two very embarrassed customers. They were very apologetic though, and insisted on paying me for my time...

Well now! What do you think of that one? When I read these stories for the first time, I try to anticipate the outcome. It helps me to better describe what is going on. But Colin had me completely fooled with that one.

I simply couldn't imagine any set of circumstances that would apply to any kind of TV or VCR, anywhere on earth! I just didn't think about an external cause for the symptoms. Did you?

And can't you imagine the puzzlement of those two old folk. Any strange noise at 2.05am is disturbing, but one coming from something as complex as a VCR must have had them wondering if the aliens had landed!

Only one puzzle remains. If that really was a child's watch, surely the old folk would have recalled a visit by their grandchildren at about the time the trouble started. That might have led to an earlier recognition of the source of the problem. But then again...

Thanks, Colin. I think most readers will have enjoyed the telling of your amusing little story. ❖

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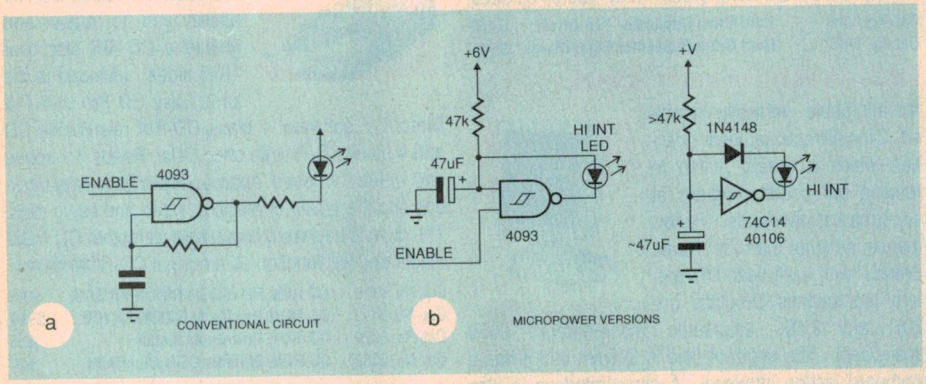
READER INFO NO.11

Circuit & Design Ideas

Interesting original circuit ideas and design tips from readers. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. We therefore cannot accept responsibility, enter into correspondence or provide any further information.

Micropower single gate LED-Flasher



In the conventional circuit (a) the output changes when the capacitor charges/discharges to the upper/lower threshold point of the Schmitt trigger input (i.e., a relaxation oscillator). Current through the LED is limited by a series resistor which drops most of the output voltage across it, wasting energy especially since the duty-cycle is approximately 50%.

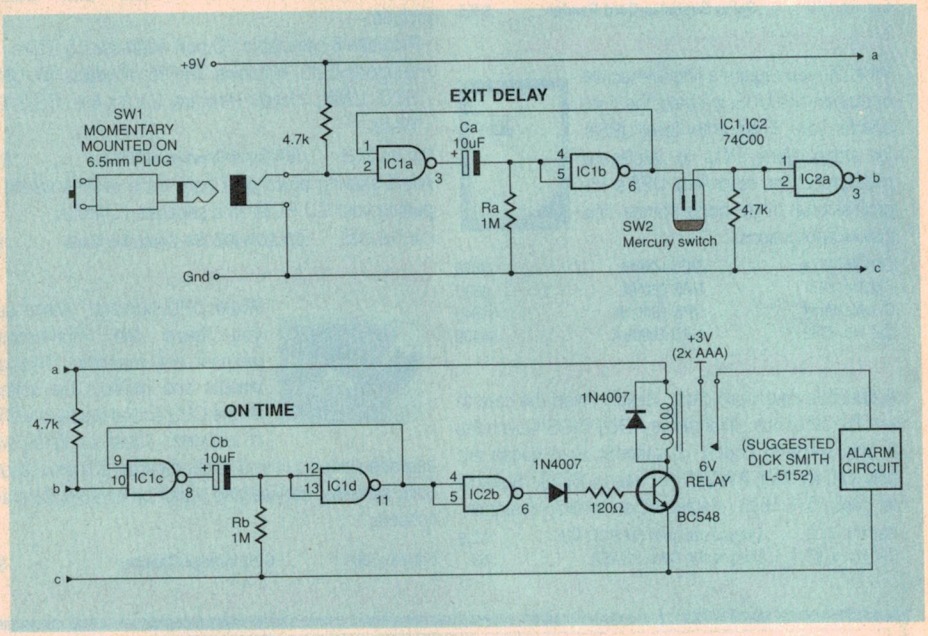
In the micropower version a large value capacitor (33-100uF) is charged via a 47k resistor to around 2/3Vdd (upper threshold). While charging, the output is high and the high intensity LED is reverse biased. When the capacitor voltage exceeds the gate's upper threshold, the gate's output swings low and the capacitor discharges via the now forward-biased LED into the output. As the capacitor voltage falls below the gate's lower threshold, the output reverts to high and the cycle repeats.

Since the upper threshold voltage is only 2/3Vdd, less energy is wasted and the considerable charge of the capacitor is released in a brief but bright flash. The mark/space ratio is governed by the time to charge the capacitor from 1/3 to 2/3Vdd, and the capacitor's value and impedance determine the brightness and duration of the flash.

This circuit won't work reliably with voltages below 5V. At voltages over 6V a signal diode must be inserted in series with the LED to protect it from reverse voltage breakdown. The circuit is most efficient with voltages between five and 10 volts and a resistor value larger than 47k. Current consumption is less than 60uA at 5V, and less than 300uA at 10V.

Manfred Schmidt
Edgewater, WA **$30**

Mercury tilt switch alarm



I occasionally set up and mix PA systems for concerts, and I would often like to take my test equipment with me on the job — but you can't just leave your gear unwatched while you are busy. With this little add-on circuit, the 110dB Personal Alarm from Dick Smith Electronics has been turned into a movement sensor device.

An exit delay is provided to allow you to set up the unit, disabling the circuit for a time determined by the resistor Ra and the capacitor Ca. When the circuit is triggered, the signal passes through the mercury switch, is inverted by IC2a and the same type of timing circuit activates the relay for a time determined by resistor Rb and capacitor Cb. Note that the 4.7k resistor on the input of IC2a is to prevent a floating input when the mercury switch is open. A 6.5mm phono plug and socket were used so the disabler itself could be removed, stopping others from disabling it also. The plug incorporates a normally open momentary pushbutton which shorts the input of IC1 to ground when pressed.

When not wanted, the alarm can be disabled by the 'cord' provided on the the alarm unit. Despite this, the relay will still be activated whenever the mercury switch is closed. Depending on your use of the circuit, you may wish to disable the relay when not in use, particularly when travelling. The circuit of course has many other options and uses. It could monitor your CRO in the workshop, and you could add an extra three mercury switches in parallel with SW2 to detect tilt in any direction.

Ben Hammann
Windang, NSW **$30**

Fuel pump safety cut-out

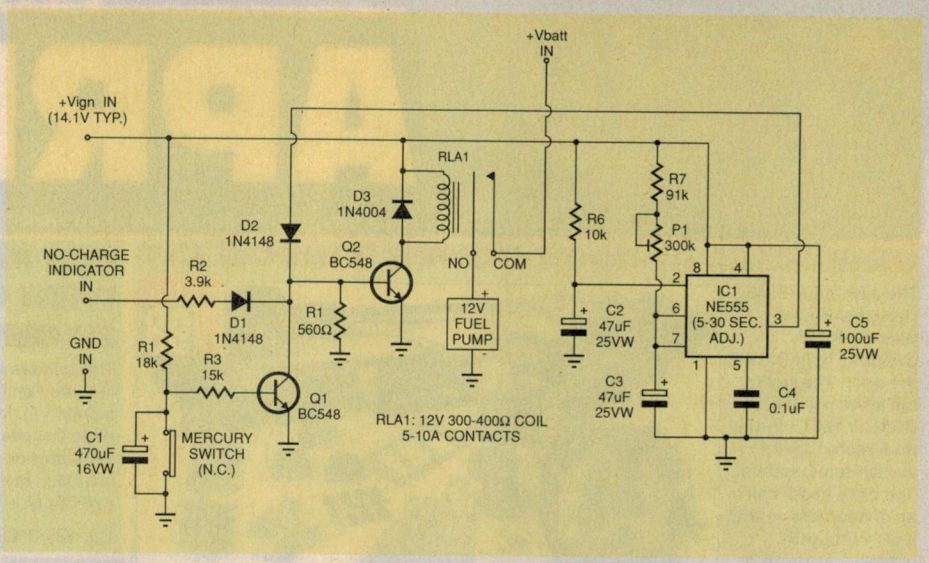
I was recently asked if I could fit a relay to an after-market electric fuel pump so that it would only operate when the vehicle's engine was running. That is the basic function of this circuit, but a couple of additional features have been added to improve its performance.

In brief, when the ignition is first turned on, the unit allows the fuel pump to run for a short period before shutting it off, unless the engine is running. Also, in the unlikely event of the vehicle rolling onto its roof, the fuel pump will cut out after about 0.2 - 0.5 seconds to help reduce the fire risk.

In operation IC1, a 555 timer, is powered from the ignition switch in parallel with the ignition coil. At power-up, a short trigger pulse is applied to pin 2 via the R6/C2 combination. A timed positive pulse is output on pin 3, the duration of which is determined by the values of C3 and P1+R7 (adjustable between about 5 and 30 seconds with the values shown). This pulse turns Q2 on, thereby energising the relay (RLA1) and supplying power to the fuel pump for the timed period.

Feedback is taken from the no-charge indicator terminal of the alternator so that the fuel pump will always operate while the engine is running. This signal is applied to the base of Q2, turning it on etc. as above. Diodes D1 and D2 act as a simple OR gate, allowing either or both signals to act on Q2.

A glass-bulb type mercury switch is used to sense a roll-over situation. This switch is fixed in a vertical position after the unit has been installed in the vehicle. (I mounted the mercury switch close to the relay on the prototype PCB and then used double-sided tape to fix the switch in a vertical position against the side of the relay.)



C1/R1 provide a short delay so that bumps etc. will have no effect on the fuel-pump. But if the mercury switch contacts are open for longer than about 0.2 - 0.5 seconds, Q1 turns on, immediately disabling the fuel pump until the vehicle returns to within 90° of its normal horizontal position.

The electric fuel pump used for testing drew around 750mA at 14.2V, so any relay with contacts rated higher than about 3A should suffice. (I used the Altronics S-4202 relay, with a 12V coil and 5A contacts.)

Although all of the vehicles that I checked were OK, some care needs to be taken to ensure that the alternator no-charge indicator is of the correct polarity. It needs to be near earth potential when the ignition is turned on but the engine is not running, and high when the engine is running.

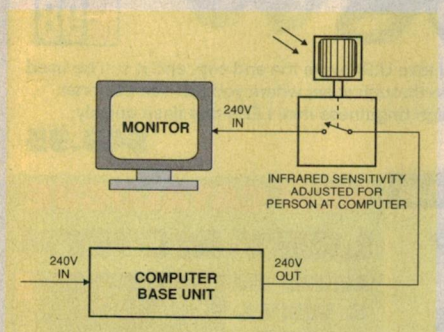
I'm prepared to supply kits for this unit if anyone is interested — phone (02) 6654 5458.

Steve Carroll
Timmsvale, NSW **$40**

THIS MONTH'S WINNER!

Hardware screen saver

The idea of this circuit is to use a slightly modified 'auto porch light' to control the power to your computer monitor, as a screen saver. It can also help with modern PCs, which often have no switched mains outlet to control the monitor or other peripherals.



Porch light controllers can be purchased quite cheaply from the larger chain stores, and can be readily modified to suit. Use a plastic box and install the switching circuitry inside, with the actual sensor mounted on top. The lamp sockets can be removed and the output wired to a three-pin mains socket mounted on the back of the box. The box is then installed close to the computer, and any activity nearby then switches on the monitor.

Normally these units have sensitivity controls along with a timer control, and these can be set so that when someone is sitting at the computer the monitor will remain switched on. When they leave, the monitor will switch off, and re-activate when they return.

With judicious setting of the sensitivity control (or by blocking out part of the sensor's window), the unit would operate only while somebody was actually at the keyboard. Conversely, the unit could be very sensitive and so stay on for as long as you were in the room.

Adrian Gibbs
Jindalee, Qld. **$25**

WIN OUR 'IDEA OF THE MONTH' PRIZE!

As an added incentive for readers to contribute interesting ideas to this column, the idea we judge most interesting each month now wins its contributor an exciting prize, in addition to the usual fee. The prize is a complete closed circuit TV system, comprising a 5" B&W video monitor, CCD video camera with stand, power supply and cabling. This system comes from our sponsor Allthings Sales & Services, and is valued at $369.00!

Jaycar ELECTRONICS APRIL SALE

Prices valid until April 30th.

All prices in Australian Dollars - New Zealand customers please ask for New Zealand prices.

UNIVERSAL IN-DOOR POWER WINDOW KIT

The Jaycar LR-8840 Universal Power Window Kit is designed to fit INSIDE the door. The key to the system is the REALLY NIFTY in-the-door motor drive / transmission system. The drive head has a kit of adaptors so that it will mate with virtually any make of winder mechanism. You also get a kit of "blanks" to cover where the winder hole is (was!), in your door trim. In addition to this you get the complete wiring wiring harness fully made up! You also get a swag of other brackets, springs, clips, screws and other hardware to make your job easier. The downside to all of this is that the instructions are fairly crude. They are quite pictorial but we cannot say that they are great, You WILL need to be fairly mechanically skilled and motivated to do the job. Aftermarket fast glass costs between $800 - $1,000 installed so you will save a bundle by doing it yourself.

2 DOOR VERSION Cat. LR-8840 **$249.00**

CCD PCB CAMERA WITH INFRA-RED ILLUMINATION

This camera includes six IR LEDs mounted on the PCB for 24 hour monitoring. ie. It can "see" in the dark. Despite the use of IR LEDs, the incredibly compact nature of the camera has been maintained at just 32 x 38mm For audio, use Cat QC-3468 add on audio board $19.95.

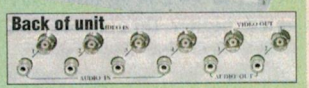
Cat. QC-3465 **$135.00**

CEILING ALARM WITH REMOTE CONTROL

This stand alone alarm utilises a passive infrared detector with a 360° lens, and an ultra loud 130dB piezo alarm to provide no-hassles home, apartment, office, garage, boat or caravan protection. Spare remote controls available Cat LA-5153 $14.95ea

Cat. LA-5152 **$54.95**

CCD 4 WAY CAMERA SWITCHER



This automatic switchbox accepts up to four video inputs from CCD/CMOS cameras on up to two video monitors. For example, you can scan cameras "1" and "2" and display on video monitor number one, and scan cameras "3" and "4", with their outputs displayed on the second video monitor. This is just an example and in fact any combination of the four cameras can be scanned and displayed on either monitor. Audio channels are provided for each of the separate inputs and outputs. This product is straight-forward to use, with on screen instructions to set up camera switching, inter-camera scan time duration and time/date information. Mains adaptor incl.

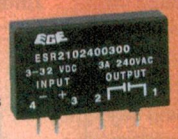
Cat. QC-3480 **$229.50**

1,000,000µF (1 FARAD) 20V DC CAR AUDIO REINFORCING CAPACITOR

One farad caps serve to bolster the power supply of your car's audio amplifiers by acting as a reservoir. They also lower supply line impedance and remove most DC ripple. Also includes mounting bracket.

Cat. RU-6750 **$199.00**

3-32VDC SOLID STATE 240VAC @ 3A RELAY



This is a PCB mounting, single in line package relay capable of switching up to 240V AC at 3 amps. Use this relay in conjunction with our new remote control switches for safe 240V AC mains switching. Specs: Input Circuit •Control Voltage Range: 3-32V DC •Min. turn off voltage: 1V DC •Control Current: 15mA Max •Input Resistance: 2.2kΩ min Output Circuit •Max load current: 3A RMS •Nominal Line Voltage: 240V AC •Load Voltage Range: 24-280V AC •Min. Blocking Voltage: 600V AC •Max one-cycle surge current: 80A RMS • Dimensions:10(D) x 42(W) x 25(H)mm

Cat. SY-4080 **$19.95**

MULTI SYMBOL KEYRING LASER POINTER

This fantastic new laser pointer comes with 6 different screw-in end caps, each one being a fun symbol - skull, victory sign (2 fingers), an arrow, cupid, a woman and I love U.Remove the end cap, and it can be used as a normal laser pointer. It has a clear, see through case, where you can see the inner workings. There are also 2 red & 2 green high brightness mini LEDs that flash quickly.

Cat. ST-3104 **$49.95**

EMAIL ORDERS mailorders@ jaycar.com.au

12V DC 1AMP REGULATED POWER PACK

Brand new unit for 1998. Delivers 12V DC at any current draw up to 1 amp. Ideal for sensitive equipment that requires spot on voltage. Supplied with 7 plugs. Desktop type unit.

Cat. MP-3033 **$32.95**

24V DC 1AMP REGULATED POWER PACK

Brand new unit for 1998. Regulated power supply means that it will deliver 24V at any current drawn up to 1 amp. This power supply is in a desktop style case with 1.8 metre long 240V power lead and 1.8 metre output lead to 7 plug adaptors .

Cat. MP-3037 **$42.95**

NEW CATALOGUE LAST MONTH

SEND $2 & WE'LL POST YOU ONE JAYCAR PO BOX 185 CONCORD 2137,

PROGRAMMABLE ENTRY ALARM / CHIME

This unit simply mounts on a door or window. When the door or window is opened the unit either chimes, or the siren goes off. It is switched on/off by a keypad and there is also a panic button for emergencies. Includes 2 warning stickers. Requires 3 x AAA alkaline batteries (not supplied). Uses magnetic sensor switch for contacts. Limited qty. Cat. LA-5160

~~Was $49.50 $24.95 $17.95~~

April $12.95

WINDOW / DOOR MAGNETIC SENSOR ALARM

This small alarm is designed to be mounted on a window or door. When the door / window is opened, a built-in 90dB alarm sounds. Its very compact and has an on/off switch on the body. If a burglar forces a window open and the alarm sounds, there is a very good chance the burglar will leave. If you want to open the window, simply turn it off. Colour-white. Supplied with 2 alarm stickers, double sided adhesive tape and screws. Limited quantity. Cat. LA-5165

~~Was $19.95 $9.95 $7.95~~

April $5.00

VIBRATION DOOR / CHIME / ALARM

This unit simply hangs on the door knob inside a room. When the door is opened or shaken it will "sound". There are 2 sounding settings - chime and alarm. Operates from a 9V battery (not supplied). Includes 2 alarm stickers. Cat. LA-5170 Limited quantity.

~~Was $19.95 $7.95~~

Now $5

12V WIND UP EXTENSION REEL

Winds into its plastic housing for easy storage. The cable length is 4 metres. The reel has two cigarette lighter sockets for powering equipment. Size: 115mm diameter. Current 10A. Ltd. qty. Cat. PP-2016

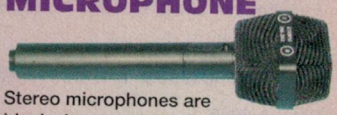
Was $12.95 April $8.95 Save $4

LIGHT OPERATED SWITCH

This controller uses a Cadmium Sulphide (CdS) cell to detect an ambient light level, the sensitivity is adjustable. When the level of light reaches a certain value the relay (with N.O. or N.C. outputs) switches on, it remains on until the light level falls below a predetermined value. Cat. AA-0344

Was $14.50 April $10.50 Save $4

STEREO CONDENSER MICROPHONE



Stereo microphones are ideal when you are recording into stereo VCR or a stereo tape deck.If one mic is used, only one channel is recorded, its a bit difficult holding 2 mics!! This mic is two channel and has two 6.5mm plugs for output (Clearly marked with L and R.). Its condenser, requires 1 - AA battery. Supplied with mic holder. Ideal for outside use because includes special built in wind screen. •Freq resp: 100Hz - 16kHz •Sensitivity: -68 +/-3dB •Output Imp: 600Ω •Cord: 3 metre with 2 x 6.5mm plugs •Power supply: 1.5V AA battery

Cat. AM-4095 **Was $39.95**

Now $29.95

Save $10

AUSTRALIAN FLAG

Our Australian flag measures 900 x 600mm and is made from polyester. Hang one outside your home, over a window, on a flagpole, anywhere you like. Cat. BF-8500

Was $9.95 April $5

WALK-BY SAFETY SECURITY LIGHT

NEW in 98

...portable light ... use a PIR detector to ...ate the light from 5 to 30 ...onds after movement has been ...ected. It can be mounted on a ... or placed on any flat surface. ...t in stairwells, childrens room. ...e, cupboards, sheds, attics, ...caravans, etc. The unit can be ...y powered using 4 x D cell ... (not included - use our SB-2343) or use a ...tor. MP-3016. As the walk by light ... battery power is conserved ... one walks past the PIR ...

REMOTE CONTROL MINI ALARM WITH PIR DETECTOR

NEW in 98

This is a self contained alarm with inbuilt PIR detector and siren. The detector can pick up movement up to 7 metres away, making it perfect for home, apartment, garage, office boat or caravan security. Features include: •ultra loud 130dB siren •arm/disarm remote control with keyring •use four AA alkaline cells (not included,) or an AC adaptor - use our regulated MP-3030 plugpack.

Cat. LA-5142 **$47.95**

SPARE REMOTE CONTROL Cat LA-5143 $17.95.

EXTERNAL SIREN Cat LA-5144 $18.95.

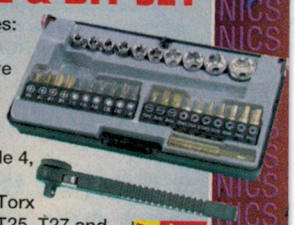
RARE EARTH NEO "SCARY" MAGNET

NEW in 98

Last year we made a surplus purchase of uncoated ferrite rare earth magnets. They were immensely popular but with a limited quantity only, they sold out within weeks. These new magnets are nickel coated to prevent the magnet from shattering, and are supplied in their own protective iron shielding case for transportation. These magnets are so strong that they're scary - especially when in pairs!! Their incredible power will simply blow you away & challenge your thinking about magnets.

20(d) x 5mm Cat. LM-1618 **$12.95**

32 PIECE RATCHET HANDLE & BIT SET



This kit includes: •Phillips No.0, No. 1 •Posidrive No. 2, No. 3 • Torx 1.5, 2, 2.5, 3, 4, 5 and 6mm • Flatblade 4, 5, and 6mm •Tamperproof Torx T10, T15, T20, T25, T27 and T30. But wait - that's not all! You also get a great range of sockets: 4.5, 5, 5.5, 6, 7, 8, 10, 12, 13 and 14mm. This kit includes a quality, well made ratchet handle with reverse action lever and a nice non-slip handle. The bits are a collection of gold plated chrome vanadium and chrome vanadium steel and heat treated. Supplied in a neat, plastic carry case. Cat. TD-2043

NEW in 98

$19.95

SEALED LEAD ACID BATTERIES

6 VOLT

Lower prices for 1998. New 18AH 12Volt

NEW in 98

4 AMP Cat. SB-2496 **$17.95**

12 AMP Cat. SB-2497 **$29.95**

5 AMP LANTERN BATT. Cat. SB-2498 **$29.95**

12 VOLT

1.3 AMP Cat. SB-2480 **$24.95**

4.2 AMP Cat. SB-2484 **$32.95**

7.0 AMP Cat. SB-2486 **$39.95**

18 AMP Cat. SB-2490 **$79.95**

NEW KIT - VIDEO FADER & WIPER

NEW in 98

Ref EA April 1998. Make your home videos professional!!! Similar to our video enhancer /stabiliser kit, this kit will accomplish manual video fading and wiping in black, grey and white. It also allows background fading with horizontal & vertical wiping, it has as on board enhancer so you won't lose any signal. Kit includes box, silkscreened front panel and all quality electronic components. Power source required 12VDC @ 150mA use MP-3002 $11.50.

Cat. KA-1807 **$69.95**

EQUATOR

NEW MODEL

"FULL FEATURE" 260 CAR ALARM

NEW in 98

Brand new 1998 model Equator car alarm with ALL the very latest technology. This car alarm has everything that you could possibly ask for. See the list of features following! The Equator 260 is supplied with 2 brand new black keyfobs with slightly recessed (but easy to use) switches. The alarm is supplied 2 ways, with either the new mini sized standard siren, or the mini sized backup battery siren. The new small sirens make them much easier to mount in smaller cars. Features: **•Active arming. •Anti scanning. •Automatic Rearm. •Carjacking countermeasures. •Chirp Delete. •Code Learning. •Domelight Delay. •Door Lock/Unlock. •Door Security Warning. •Engine Killer. •Hard programming. •Instant Trigger. •Last Door Arming. •LED Status Indicator. •Light Flash Confirmation. •Non Volatile Memory. •Overide Switch. •Parking Lot Panic/Car Search. •Power interrupt alarm. •Programmable Features. •Random Code Transmission. •Remote Boot Release.•Rolling Theft Protection. •Sensor bypass. •Shock Sensor. •Trigger Memory Indicator. •Valet Mode. •Voidable Code Viability.**

GREAT VALUE

Equator 260 - What you get

• Blackbox electronic module with all the above features • 2 transmitter key fobs • Ignition cut out relay • Shock sensor • Wiring • Mini Size Siren

Cat. LA-8940 **$219.00**

Spare Code Learning Remotes

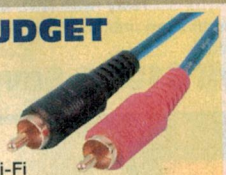
Cat. LA-8945 **$34.95ea**

Equator 260 Back Up - What you get

• Blackbox electronic module with all the above features • 2 transmitter key fobs • Ignition cut out relay • Shock sensor • Wiring • Mini Size Back up Battery Siren

Cat. LA-8950 **$239.00**

GOLD 2 RCA - 2 RCA BUDGET AUDIO LEADS



NEW in 98

This range of leads feature moulded gold plated RCA plugs on a single shield blue cable with a centre wire for remote amp switching or home Hi-Fi grounding. Fig 8 cable with each lead 3.5mm OD.

Cat. WA-1055	1.5 metres	$7.95
Cat. WA-1056	2.5 metres	$9.95
Cat. WA-1058	5.0 metres	$13.95

PROFESSIONAL OFC DOUBLE SHIELDED RCA LEADS

NEW in 98

The cable is heavy duty, double shielded figure 8, purple in colour with a central lead for remote amp switching or grounding on home Hi-Fi systems. Each lead is 6mm OD with a nice flexible rubber insulation & features a pair of gold plated high quality metal RCA plugs on each end.

Cat. WA-1090	1.5 metres	$24.95
Cat. WA-1092	2.5 metres	$29.95
Cat. WA-1094	5.0 metres	$34.95

2 RCA PLUG TO 1 RCA SOCKET OFC Y-CABLE

NEW in 98

Use this lead to split a line level from your car audio deck to two separate power amps or active crossovers etc. Supplied with moulded gold RCA connectors on a 30cm length of screened audio cable.

Cat. WA-1065 **30 centimetres** **$7.95**

HEAVY DUTY CAR NOISE SUPPRESSOR

NEW in 98

This filter is suited to high-end audio systems that draw anywhere from 40 amps to 120 amps. It has an excellent LC network which comprises, 4µH and 0.5µH choke plus 6, yes 6 x 4,700uF filter capacitors - a total of 28,200 uF of filtering! Connections are via three gold terminal sockets to suit 4AG cable.

Cat. AA-3080 **$79.50**

11 PC CELLULAR PHONE TOOLKIT

NEW in 98

Service your own mobile phone! This kit includes essential tools to access the internals of mobile phones. You get: •Torx T5 and T6 •Tamperproof Torx T8 • Phillips No 3 •Flatblade No 2 plus pin drive (snake), an angled flatblade tool to help pry lid assemblies plus two custom antenna release toolbits and dedicated driver. Quality chrome vanadium presented in a felt lined carry case.

Cat. TD-2024 **$24.95**

6 PIECE PRECISION TAMPERPROOF TORX SET

NEW in 98

A quality set of chrome vanadium drivers consisting of T7, T8, T9, T10, T15 and T20. All drivers are 145mm length & presented in a felt-lined plastic case.

Cat. TD-2021 **$14.95**

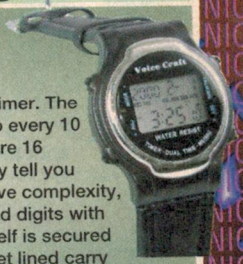
METAL MAGNETIC DISH

NEW in 98

This clever product will retain all manner of hardware. The enamel coated metal bowl is magnetised, even if the bowl is tipped over the parts will stay put. Rubber non slip base.

Cereal dish size. Cat.TH-1970 **$9.95**

MULTI-FUNCTION TALKING WATCH



NEW in 98

This watch features dual time zones, alarm and countdown timer. The countdown timer delivers voice reports from every second to every 10 minutes depending on the countdown time duration. There are 16 different alarm 'songs' to choose from. The watch will literally tell you the time with just the press of a button, and despite its relative complexity, is easy to operate. The watch LCD features large easy to read digits with both the time and date displayed at once. The time piece itself is secured to a nice leather wrist band, and is presented in its own velvet lined carry case. Includes battery and instruction manual

Cat. XC-0280 **$24.95**

12V 2A Solar Battery Charger Regulator

NEW in 98

This compact regulator protects the battery against overcharging, discharging at night and deep discharge. Installation is straight forward with just 3 wire pairs: solar panel, battery and load. Two status LED's are included to indicate load and charge states.

Specs: •Nom voltage: 12V •Max solar panel voltage: 24V •Max solar panel current: 2A •Overcharge volt limit: 14.2V •Discharge volt limit: 10.8V •Regulator consumption: 5mA

Cat. MP-3120 **$69.95**

MAIL ORDER - FREECALL FOR PHONE ORDERS 1800 022 888

8 SECOND KEYRING RECORDER

NEW in 98

This is a digital sound recorder that you can use for messages on the fly - shopping list info, meetings, ideas, etc.8 seconds you say! You will be suprised that 8 seconds doesn't sound much is more than enough for voice memos.

Cat. XC-0272 **$14.95**

650 CABLE TIES - MIXED CAN

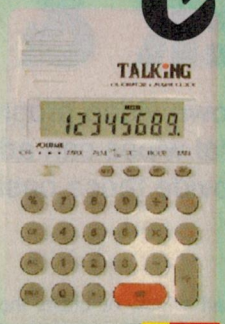
NEW in 98

An excellent assortment of cable ties for hobbyists, automotive, marine or home gardening! This great pack's got the lot: 100 pcs x 100mm white, 200pcs x 100mm assorted colours, 300pcs x 200mm white, 50pcs x 285mm white.

Cat. HP-1208 **$19.95**

TURN YOUR SURPLUS STOCK INTO CASH!
Jaycar buys surplus/distress stock of most electronic products from components to built products.If you have marketable quantities of stock you need to clear contact Bruce Routley on
Ph: 02 9743 5222 Fax: 02 9743 2066

TALKING CALCULATOR ALARM CLOCK

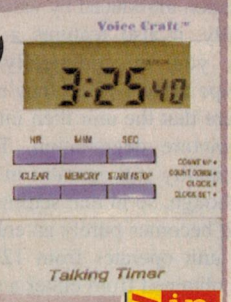


NEW in 98

Each keystroke is met with digitised speech, whilst each calculating function such as division and subtraction is clearly spoken. Calculation results are also spoken, including decimal points with the ability to repeat the result with the single touch of a button. Other features include adjustable volume (which can be switched off), & a clock with alarm.

Cat. QM-7275 **$24.95**

Talking Up/Down Timer with Clock

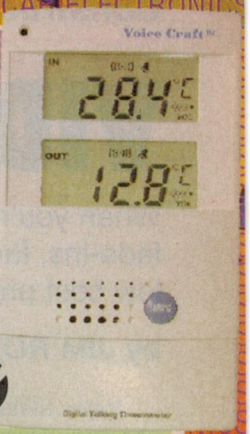


NEW in 98

This timer counts up or down and provides a verbal report every second or every hour, depending on the time period remaining. At the end of the event, one of six alarms will sound. Other features include 3 independant timer functions, auto timing repeat, talking clock plus memory to store frequently used timing.

Cat. XC-0284 **$19.95**

TALKING INDOOR OUTDOOR THERMOMETER



NEW in 98

With this unique thermometer, you can wake up to a voice report of both the inside and outside temperatures every 15 minutes for the first hour after the alarm goes off. Features include: •hourly temperature announcement •high and low temperature alerts •daily high/low temperatures •specific period min/max temperatures •adj. volume •C° and F° selection. Sensor is also included, with a handy 3m long wire lead.

Cat. QM-7215 **$34.95**

TALKING CALENDAR THERMOMETER ALARM CLOCK

NEW in 98

This is a desk top calendar that also displays time and temperature. A large push button at the top of the unit activates time & temperature voice announcements. The LCD displays one full calendar month along with the time and temperature.

Cat. XC-0282 **$29.95**

Surface Mount Hinged Speaker Brackets

NEW in 98

Made from high strength fibreglass material and will support speakers up to 20kgs. Great for those hard to mount speakers that need to be mounted as flush as possible onto side walls or into corners. When a speaker is fitted, the swivel angle is 90°. •4pieces supplied- two per speaker.

Cat. CW-2805 **$15.95Pr**

RCA SOCKETS ON LARGE WALLPLATE

NEW in 98

Cat. PS-0292 **$4.95**

Cat. PS-0294 **$6.95**

BANANA SOCKETS ON LARGE WALLPLATE

NEW in 98

Cat. PS-0412 **$4.95**

Cat. PS-0414 **$6.95**

Tilt & Swivel Speaker Mounting Bracket

NEW in 98

Made from the same high strength material as the brackets above, these brackets are suited more towards mini speakers up to 10 kgs, with a vertical tilt angle of 15° and swivel angle up to 150°. Suitable for surround speakers or extension speakers mounted outside or in a games/ rumpus room. Supplied with 2 hinges self tapping mounting screws & nylon wall plugs. •2 pcs supplied- 1 per speaker.

Cat. CW-2806 **$19.95Pr**

EMAIL ORDERS: mailorders@jaycar.com.au **WHOLESALE EMAIL: wholesale@jaycar.com.au**

Jaycar ELECTRONICS

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FAX: (02) 9743 2066

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ROAD FREIGHT ANYWHERE IN AUST (up to 20kg) $14.00

POST & PACKING $10 to $24.99=$4.00 $25 to $49.99=$5 $50 to $99.99=$7 OVER $100=$8

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ASPLEY QLD •1322 Gympie Rd, cnr Albany Creek Rd •Ph:(07) 3863 0099 •Fax:(07) 3863 0182 •Mon/Fri:9-5.30 •Thurs:9-8.30 •Sat:9-4

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BANKSTOWN •363 Hume Hwy Cnr Meredith •Ph:(02) 9709 2822 •Fax:(02)9709 2007 •Mon/Fri:9-5.30 •Thurs:9-8.30 •Sat:9-4 •Sun:10-4

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PENRITH •199 High St •Ph:(047) 21 8337 •Fax:(047) 21 8935 •Mon/Fri:9-5.30 •Thurs:9-8.30 •Sat:9-4 •Sun:10-4

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VIDEO FADER & WIPER

When you're dubbing and editing your own video programmes, the ability to add basic effects like fade-ins, fade-outs and horizontal/vertical wipes can add a nice touch of professionalism. Here's a low cost project which allows you to provide these basic video effects.

by JIM ROWE

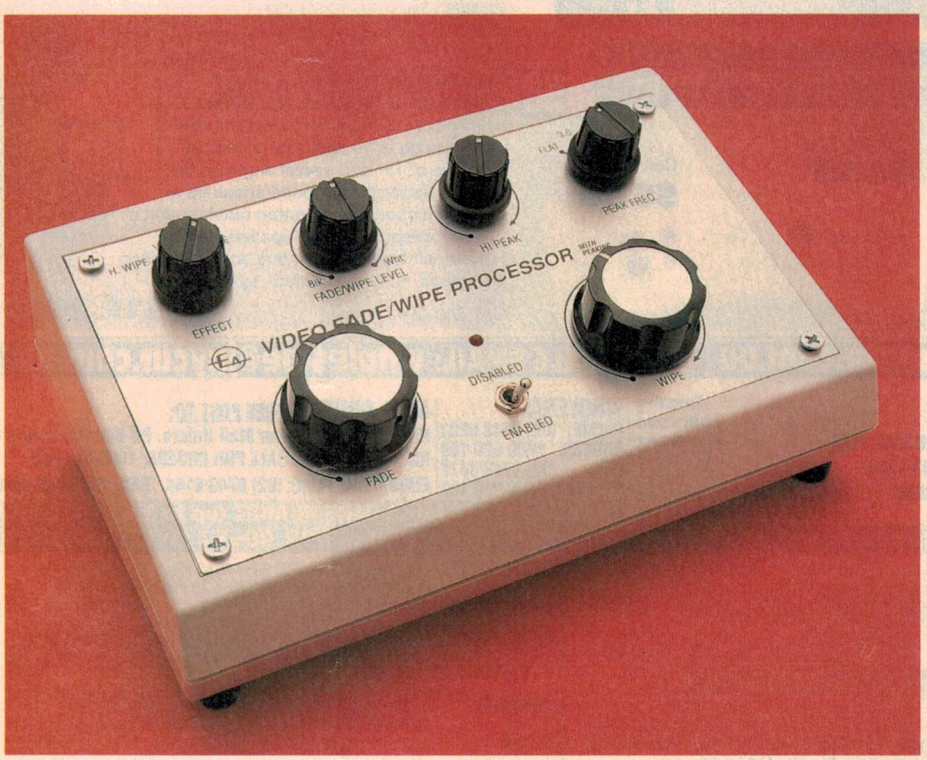
Video editing equipment always tends to be more complex than audio editing gear, because of the need to maintain sync signal and colour burst signal levels, etc. Mixing video signals from two different sources is especially tricky, because they have to be locked together somehow; that's why video *mixers* tend to be considerably more expensive than the audio variety...

Luckily, though, it's not as difficult to perform basic video 'effects' which involve a *single* video signal, like fades and wipes. And even these modest effects can add a touch of professionalism, when you're editing your family videotapes. You can close one scene with a fade-out or wipe-out, and then bring up the next scene with a matching fade-in or wipe-in. If your dubbing VCR has the ability to lock a new recording to the tail of the old one, you may even be able to create something approximating a lap-dissolve...

The project described here is a low-cost design which lets you produce manual video fades and wipes, of either the horizontal or vertical variety. The video 'background' level which you fade or wipe to/from can be adjusted to any shade of grey between black and white, giving a little more flexibility, and the unit also features a built-in high peaking or 'enhancement' facility which lets you compensate at least partly for the inevitable picture degradation introduced by video dubbing.

Finally, it also features a switch which allows you to completely disable the fade/wipe effects when they're not wanted, to ensure that the unit then introduces minimum picture degradation. The 'enhancement' facility still operates in the 'disabled' state, though, so in that setting of the switch the unit becomes purely an enhancer.

The unit operates from 12V DC, which can be obtained from either a standard plug-pack power supply or a 12V battery. Hopefully this should also make it of interest to those who need to add simple video effects away from the mains supply.



The prototype was built in a small sloping-front plastic instrument case, and looks quite professional.

How it works

Readers who built the Video Enhancer/Stabiliser project of November 1997, or at least read the article, will probably find that the circuit for this project looks somewhat familiar. That's not really surprising, because it has been developed from that design; when I was working on the Enhancer last year I realised that many of the circuit sections could be adapted for use in a video fader and wiper. So when the first project had been completed, I began working on this 'offspring' design.

As it turned out quite a few changes proved to be necessary in the fine details, but there are still many similarities.

The main video path through the circuit is quite similar, with the incoming video first passing through U1, a unity-gain wideband buffer amplifier (replacing the transistor used in the earlier design). It then passes through analog switches U2c and U2b (which we can consider as being 'on', for the present), and finally through the wideband output buffer/enhancement amplifier using transistors Q1 - Q4.

This latter section is almost identical to that used in the earlier design. The gain of the output buffer amplifier is basically set to two, by resistors R16 and R14, but this gain can be increased up to about five times (i.e., about +8dB) at selected high frequencies, by the shunt peaking circuitry using R15, L1 and capacitors C16 - C18 as selected by SW1. With C16 selected the peaking occurs at about 3MHz, while C17 and C18 move it down to 2.5MHz and 2MHz respectively. Adjustment of the degree of peaking is provided by pot RV8, while SW1 also allows you to select the 'FLAT' position where there is no peaking.

This then is the way the unit works when analog switches U2b and U2c are 'on', and conversely switch U2a is held 'off' by inverting gate U3c. And that's exactly what happens when the Enable/Disable switch SW3 is in the 'Disable' position, because one-shot U6a is then held in its reset state, with its Q output low. This in turn holds pin 4 of U3b low, and hence pin 6 high — which keeps U2b/c on, and U2a off.

Most of the remaining circuitry is used to achieve the video fade and wipe effects, as

you might expect. And the basic idea is that in order to preserve the video signal's picture and colour stability, this circuitry is only allowed to 'operate' on the video signal during the times that it's carrying 'live picture' information. The circuitry is disabled at all other times, when the video is carrying blanking and sync information.

How do we do this? Simply by operating analog switches U2b/c and U2a (which together form what is effectively a high-speed SPDT video signal switch) on a dynamic basis, under the control of gate U3b and the circuitry ahead of it.

Since we need to operate our video switch on a line-by-line basis and turn it on only during the 'live picture' part of the lines, we clearly need to know the exact timing of the incoming video. This is done by using U4, a low cost LM1881 sync separator chip. Buffered video from the output of U1 is fed to the input of U4 via coupling capacitor C5 and the low-pass filter formed by R5 and C4, which is used to attenuate the colour subcarrier.

U4 processes the video signal and derives from it a number of timing signals, only two of which we're using here. At pin 3 it produces negative-going vertical sync pulses, which are used to identify the start of each video field; and at pin 5 it produces negative-going 'burst gating' pulses, which correspond to the timing of each colour burst on the 'back porch' of each horizontal blanking pedestal. We use the latter to identify not only the start of each video line, but also to sample the video signal's black level — as we'll see later.

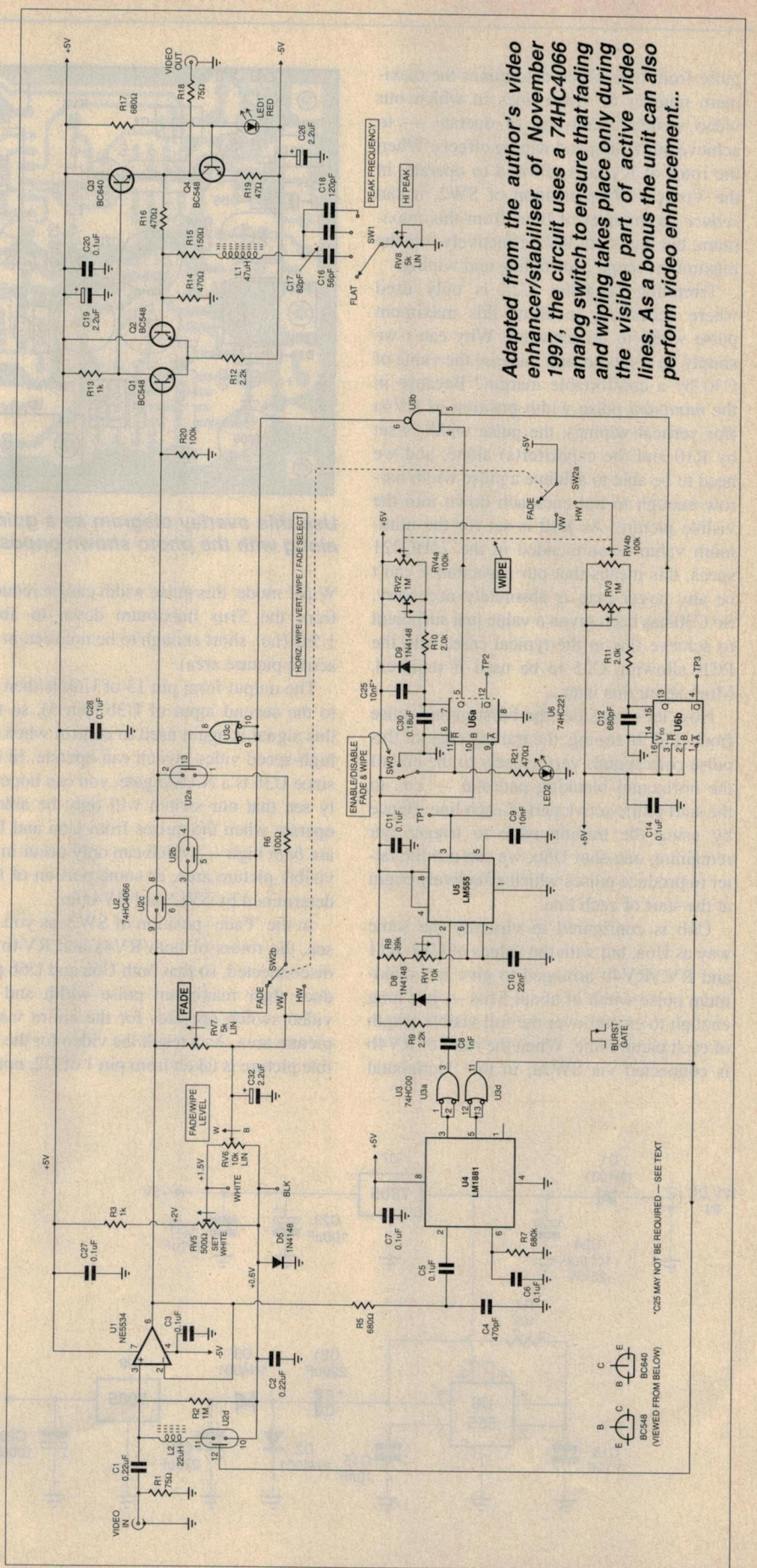
As you can see, we first pass both of these signals through gates U3a and U3d, connected as inverters. This converts them into positive-going form, for use by the rest of the circuit.

Taking the vertical pulse from U3a first, we use this pulse's trailing edge to trigger U5, a 555 timer chip used as a one-shot (monostable). Components C8, R9 and D8 form a differentiator circuit which produces a triggering pulse from the trailing edge of the vertical pulse, and R8, RV1 and C10 form the one-shot's timing circuit. Trimpot RV1 is used to set the one-shot delay time to about 1.1ms — i.e., so that its output pulse lasts until just before the end of the vertical blanking interval, and the start of the active picture lines.

We use the trailing edge of U5's output pulse in turn to trigger U6a (half of a 74HC221), which is used as another one-shot. So U6a is triggered just before the start of the active picture lines (when SW3 is in the 'Enabled' position), and its output pulse at pin 5 is fed to one input of U3b, the gate used to control our video switch.

The output pulse width of U6a is set by capacitors C30 and C25 (which may not be needed), together with R10, RV2 and RV4a. The idea here is that RV2 is used to set U6a's *maximum* output pulse width to about 20ms — just down to the bottom of the active picture area for each field, and no further. This is done with switch SW2a in the FADE position, where the rotor of RV4a is disconnected.

Basically it's this maximum-width output

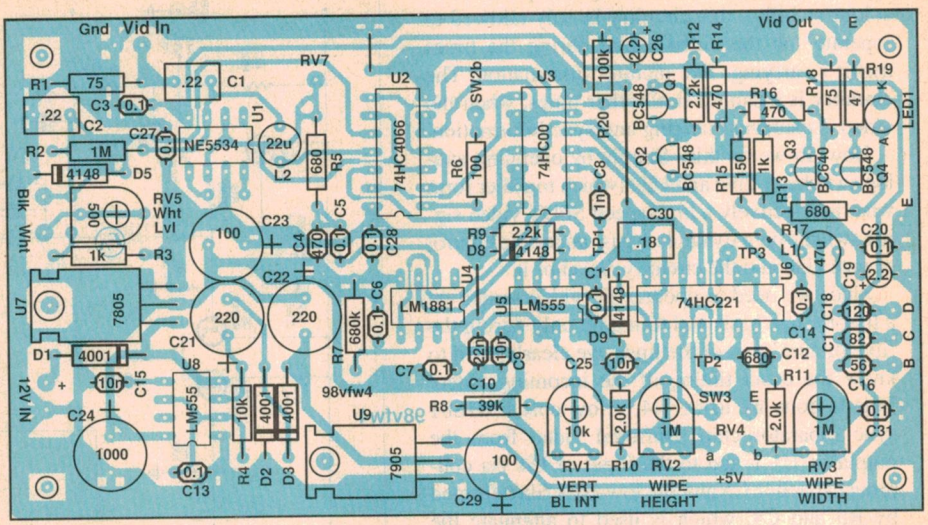


pulse from U6a which determines the maximum number of video lines in which our video switch is allowed to operate — to achieve our fading and wiping effects. When the rotor of RV4a *is* allowed to operate, in the Vertical Wipe position of SW2, it can *reduce* the number of lines from this maximum, but that's all; RV2 effectively sets the maximum 'scope', for fading and wiping.

Trimming capacitor C25 is only used where necessary, to allow this maximum pulse width to be achieved. Why can't we simply be generous and increase the value of C30 by a comfortable margin? Because in the *minimum* pulse width position of RV4a (for vertical wiping), the pulse width is set by R10 and the capacitor(s) alone, and we need to be able to achieve a pulse width narrow enough to not encroach down into the visible picture. As R10 is set for the minimum value recommended in the 74HC221 specs, this means that our capacitance can't be any larger than is absolutely necessary. So C30 has been given a value just sufficient to achieve this in the typical case, with the PCB allowing C25 to be used if required. More about this later...

Now let's consider the burst-gating pulse from U3d. In timing, the trailing edge of this pulse corresponds very closely to the end of the horizontal blanking pedestal — i.e., to the start of the active part of each line. Hence by using the trailing edge to trigger our remaining one-shot U6b, we can use the latter to produce pulses which effectively begin at the start of each line.

U6b is configured in virtually the same way as U6a, but with the values of C12, R11 and RV3/RV4b arranged to give it a maximum pulse width of about 51us — just long enough to extend over the full visible length of each picture line. When the rotor of RV4b is connected via SW2a, in the 'Horizontal Wipe' mode, this pulse width can be reduced from the 51us maximum down to about 1.5us (i.e., short enough to be not seen in the active picture area).



Use this overlay diagram as a guide in placing the components on your PCB, along with the photo shown opposite.

The output from pin 13 of U6b is then fed to the second input of U3b (pin 5), so that this signal is again used to control when our high-speed video switch can operate. In fact since U3b is a NAND gate, you can hopefully see that our switch will only be able to operate when the pulses from U6a and U6b are *both* high — which can only occur in the visible picture area, or some portion of it as determined by SW2 and RV4a/b.

In the 'Fade' position of SW2, as you can see, the rotors of both RV4a and RV4b are disconnected, so that both U6a and U6b produce their maximum pulse width and the video switch operates for the entire visible picture area. As a result the video for the visible picture is taken from pin 1 of U2, not the direct output from U1 connected to pins 9 and 3 of U2. And the video available at pin 1 of U2 is derived, via stopper resistor R6 and switch SW2b, from the fader pot RV7. So in this mode the visible part of the picture can be smoothly faded up or down via RV7, between maximum and a background level.

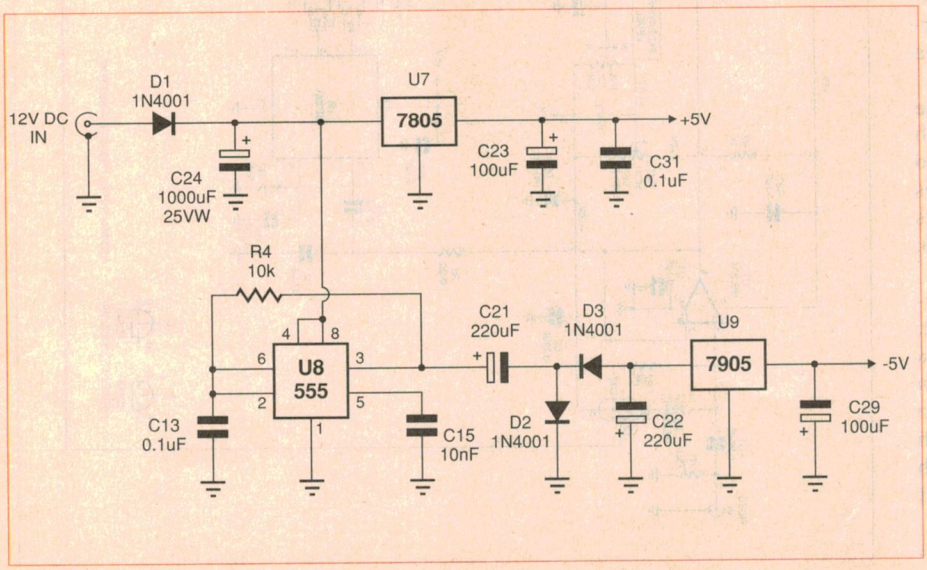
The background level is set by pot RV6, which allows the DC level at the bottom of RV7 to be set to any level between +0.6V (corresponding to black) and +1.5V (corresponding to white). The white level is actually preset using trimpot RV5, as you can see.

In the 'Vert Wipe' or 'Horizontal Wipe' positions of SW2, one rotor or the other of RV4a/b is connected to +5V, allowing the pulse width from either U6a or U6b to be adjusted via RV4. As a result, the proportion of active picture area over which the video switch can operate can be smoothly adjusted via RV4, in either the vertical or horizontal direction.

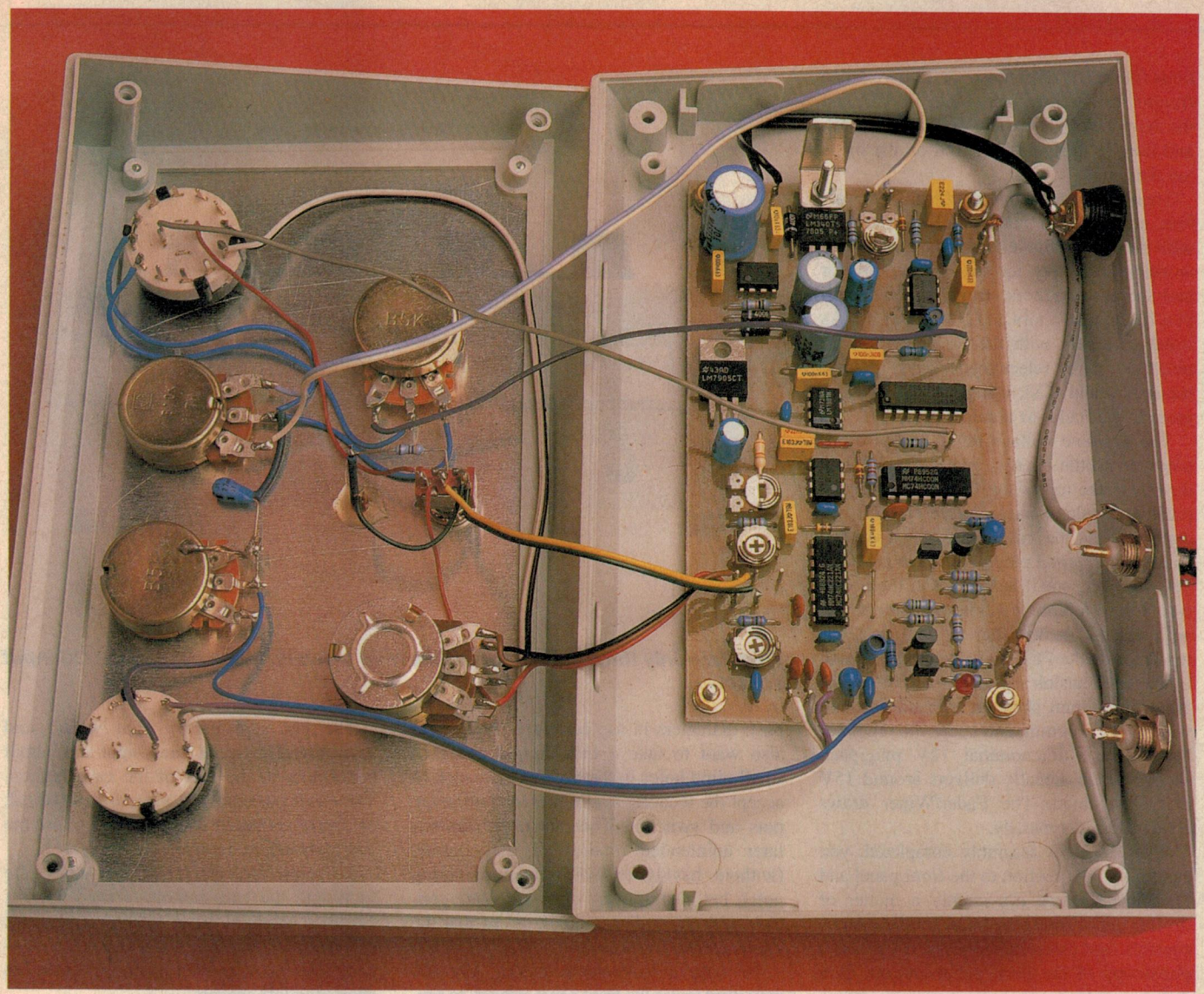
At the same time, SW2a connects pin 1 (the 'switched' video input) of U2a directly to the 'background' video level from RV6, so that the 'switched' part of the picture corresponds to the background level (black, white or any shade of grey in between). So in this mode RV4 operates smoothly as either a vertical or horizontal wipe control.

At this stage, you're perhaps wondering why it is that the +0.6V DC level at the bottom of RV6 corresponds to black level — and possibly also about the purpose of U2d, the remaining switch element of U2. I'd better explain...

To ensure that the analog switches of U2 operate correctly with the video signals, we



Here's the circuit for the power supply section of the unit, which can operate from any external source of nominally 12V DC.



This internal view should give you a good idea of the way it's put together — and also how to perform the off-board wiring. Note the small L-shaped heatsink fitted to U7, the 7805 regulator (upper right).

need to ensure that the video signal never swings negative. The simplest way to do this is to re-establish the DC level of the incoming signals, so that the sync tip levels (the most negative part of a composite video signal) are slightly positive with respect to ground. We do that here with an active clamp circuit, using U2d.

As you can see, the switching input of U2d is driven from the output of U3d, which provides inverted 'burst gate' pulses. As a result U2d is turned on only during the burst gating period of each video line — which by definition also happens to correspond to the correct timing for sensing the video signal's 'back porch' or black level. So by making U2d conduct at this time for every line, and effectively connect the positive input of U1 to the +0.6V reference established by forward-biased diode D6, we basically reset the video signal's black level to this voltage.

Since the clamp switch only operates during the very time that the video signal's colour bursts are present, we obviously have to make sure that it doesn't cause the bursts to be distorted. This is the purpose of series RF choke L2, which provides a suitably high impedance for the 4.43MHz colour bursts (while being a very low impedance for DC).

Hopefully that's given you a fairly good idea of how the main part of the circuit operates. As you can see the power supply is very straightforward, with a 7805 regulator to derive a regulated and smoothed +5V supply rail from the incoming unregulated 12V DC, and a small 'charge pump' converter around U8 and D2/D3 used to generate a -10V negative supply from the same incoming DC. This is then fed to U9, to produce a suitably regulated and smoothed -5V rail. Diode D1 in series with the DC input is to protect the circuit against damage from accidental reverse-polarity inputs.

Construction

As you can see from the photos, the Fader/Wiper is housed in a small sloping-front instrument case. Most of the circuitry is on a small printed circuit board, measuring 127 x 70mm and coded 98vfw4. The board is mounted in the bottom of the case, while the controls are mounted on the removeable 'top half'. The video input and output connectors mount on the back of the case bottom, along with the DC input connector. A relatively small number of flying leads connect them all together.

In building the unit I suggest you start by assembling the minor components on the PCB, using the overlay diagram and internal photograph as a guide. As usual it's a good idea to check the blank PCB first, to make sure there are no fine bridges between tracks, etc.

This is also a good time to fit the PCB terminal pins used for off-board connec-

tions (there are 19 of these, or 22 if you also fit pins for the three test points T1-T3), and the wire links. There are five links in all, and they're fairly easy to find on the overlay diagram.

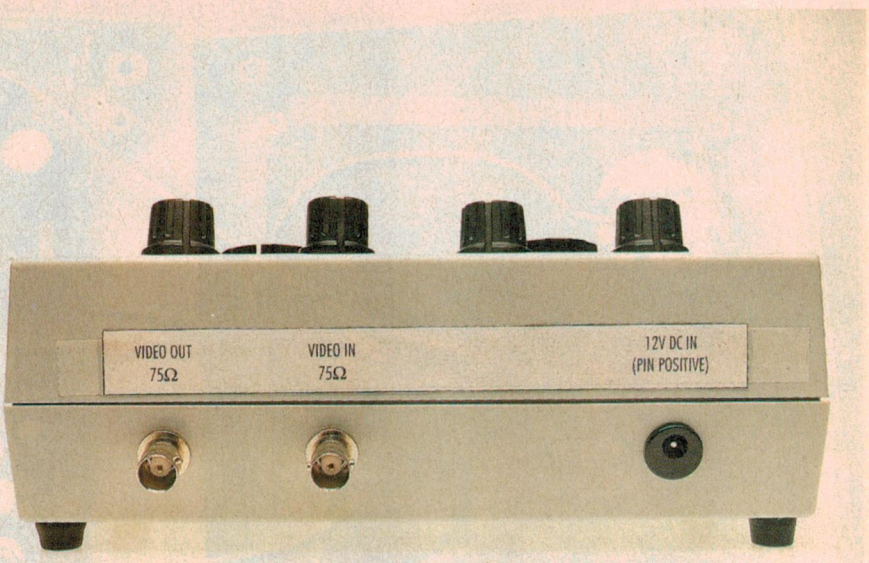
Then it's simply a matter of fitting the various components, starting for convenience with the low-profile resistors and diodes, and working your way up through the smaller and larger capacitors, trimpots, etc., until you fit the transistors and ICs last of all. As usual take care with the orientation of all polarised parts (electrolytic caps, diodes, transistors and ICs), using the overlay diagram in particular as a guide.

The negative voltage regulator U9 dissipates very little energy, and is simply 'laid down' on the top of the PCB. However the positive regulator passes more current, and depending on the 'raw' unregulated voltage from your external plug pack it can get quite hot without a small heatsink. On the prototype I used a 3mm x 12mm machine screw with nut and lockwasher to both hold the regulator on the PCB and also attach a small L-shaped heatsink cut from an offcut of 1mm aluminium sheet. It measured 10mm wide by 10 x 20mm, and keeps the regulator happy even with a nominal '12V' plug pack supply which actually delivers around 15V DC under load. The Fader/Wiper draws about 120mA, typically.

With the PCB assembly completed, you can turn your attention to the front panel and its controls. Here it's mainly a matter of drilling and reaming the holes for the various controls, and this will be easiest if you use a photocopy of the front panel artwork as a drilling guide.

I suggest that you use the actual controls as a guide to the exact diameter of each mounting hole, as there are many different bush diameters in use currently. You might also want to take a little longer and drill small blind holes in the back of the panel, to accept the locating spigot provided on many pots and switches. This not only prevents later unintended rotation of the controls (without having to over-tighten mounting nuts), but also allows you to orientate controls with pre-milled shaft 'flats' so that the knobs can be fitted easily.

To make a professional looking job, you may want to use the front panel artwork to produce a stick-on dress panel from Dynamark or similar material, and fit this to the front panel before finally fitting the controls.



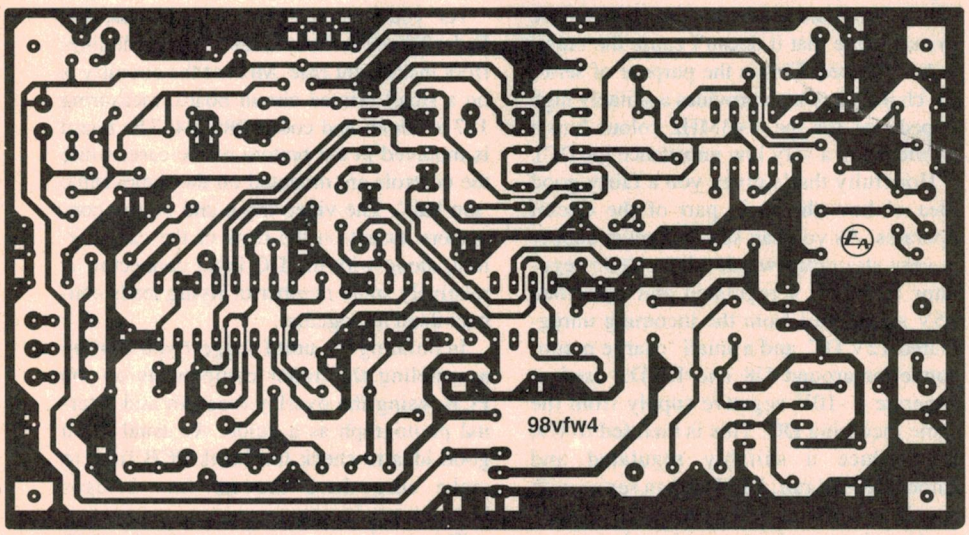
There are only three connectors at the rear: video in, video out and the DC input socket.

The last step before final wiring and assembly is to fit the three input and output connectors to the rear of the case bottom. The exact placement of these is not critical, of course, although you may want to use the label artwork as a guide.

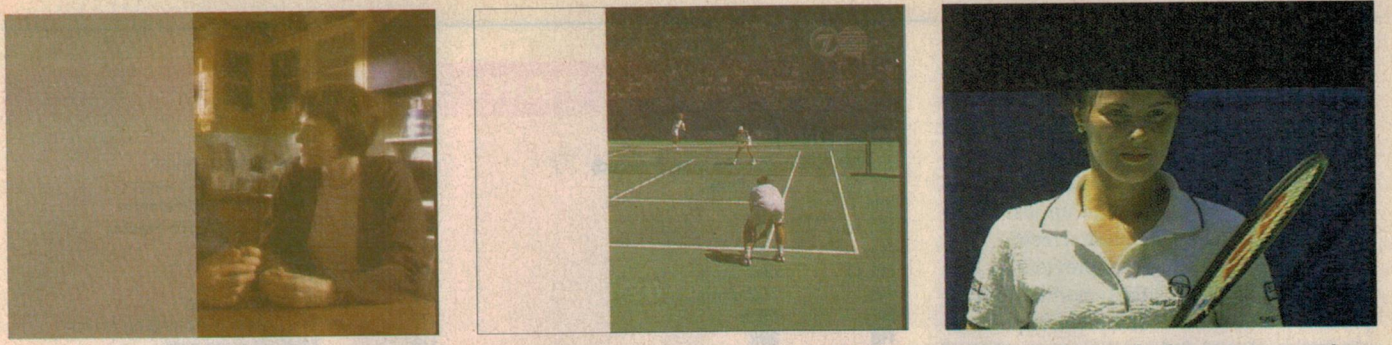
To begin final assembly, first mount the PCB into the case bottom. I used 3mm x 12mm countersink-head machine screws for this, with lockwashers and 3mm nuts underneath the board as well as on top, to act as short standoff spacers.

With the board in place, you're ready for the interwiring. I suggest you fit the leads to the input and output connectors first, using short lengths of co-axial or shielded cable for the video connections. Then you can connect up the various controls, to both each other and the board — in the latter case leaving only just enough length to allow the case to be opened in 'clamshell' fashion for servicing. Any additional length will only make the wiring more vulnerable to cross-coupling and noise pickup.

Note that in addition to the controls themselves, there are three small components mounted on the front panel: C32, the 2.2uF capacitor used to provide decoupling for the fade/wipe background level; LED2, the 'ENABLED/DISABLED' indicator LED; and R21, the dropper resistor for LED2. You can hopefully see where these are located in the internal photo. C32 spans between the rotor lug of RV6 and the earthed lugs of RV8, while R21 spans between the rotor lug of SW3 and the anode lead of LED2. The LED itself mounts directly in a 3mm hole on the front panel, of course.



Here's the artwork for the PCB, actual size for those who like to etch their own.



Three screen grabs showing the kinds of wipes that can be performed. At left is a horizontal wipe-in from grey, centre a similar wipe-out to white, and right a vertical wipe-in from black.

Testing & setup

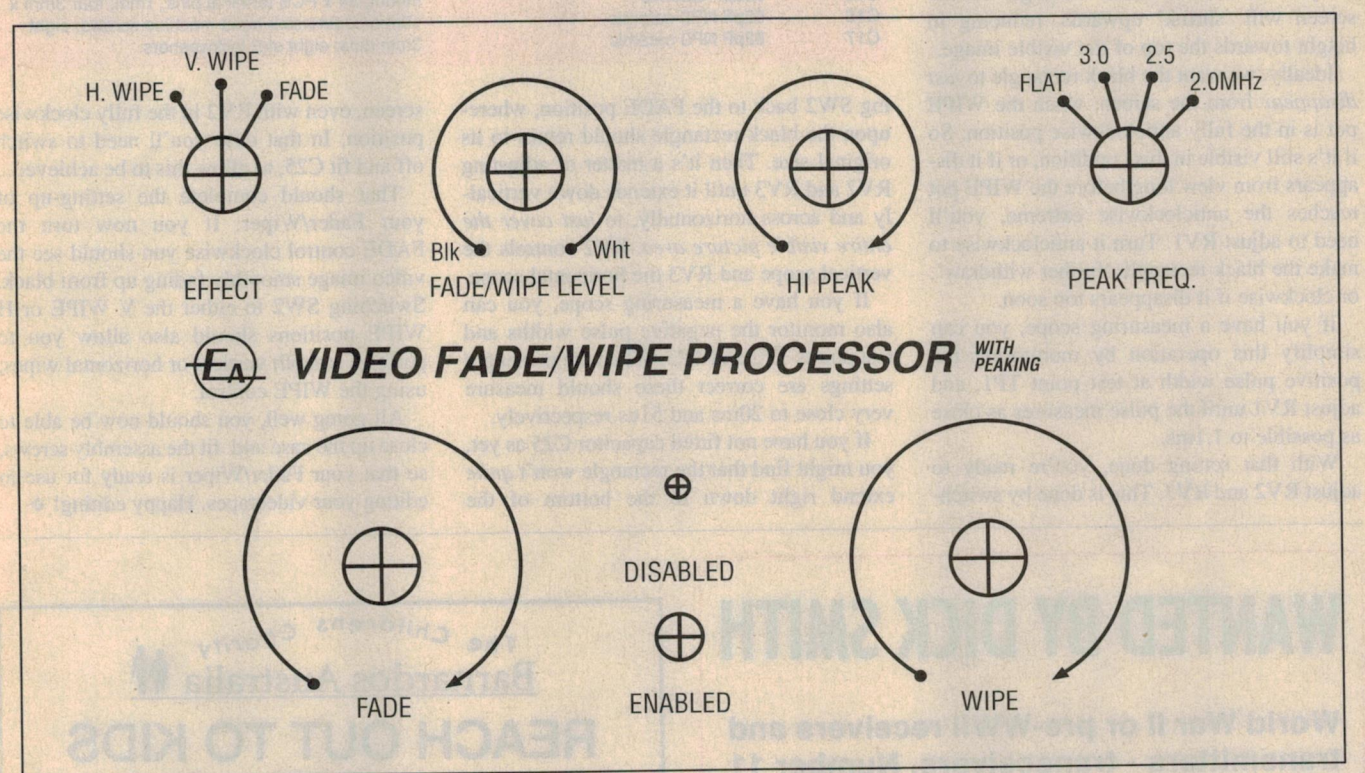
Before applying power, set all of the preset pots on the PCB to about the middle of their range. Also set the front panel PEAK FREQ switch SW1 to the FLAT position, the EFFECT switch SW2 to FADE, the FADE/WIPE LEVEL pot RV6 fully anticlockwise (Black), and the ENABLED/DISABLED switch SW3 to ENABLED. The FADE pot RV7 should also be turned to maximum (fully clockwise).

Now apply 12V power, and check whether LED1 on the PCB and LED2 on the front panel both light — as they should. In any case, quickly use your DMM to check the +5V and -5V supply rails on the PCB, at the output pins of the two regulators. If the two supply rails seem OK and both LEDs are glowing, your power supply circuitry is functioning correctly and the LEDs are also wired correctly.

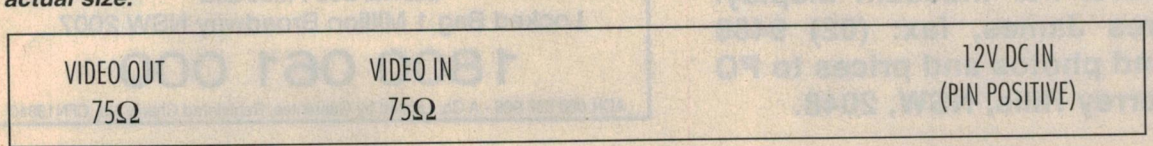
Should either of the rails not measure within a few tens of millivolts of 5V, remove power immediately and investigate why; you've probably made a wiring error, either on or off the board. Conversely if the rails measure OK but one of the LEDs isn't glowing, you've probably connected that LED around the wrong way (although with LED2, it's also possible that you've forgotten to set SW3 to 'ENABLED').

After fixing any possible wiring errors, you should be ready for the setup phase. This involves first setting the 'Set White' preset pot RV5, for a white level of +1.5V as measured with your DMM. You can monitor the voltage at the pot rotor or at the adjacent 'Wht' PCB terminal pin, and simply adjust the pot with a small screwdriver until you get a reading of 1.5V.

Now you need to feed a video signal into the unit, from say a VCR or camcorder (or



Above is the artwork for the front-panel escutcheon and below that for the label above the rear connectors, both shown actual size.



laserdisc player, etc), and also connect its output to a TV set or video monitor. There's also the option of checking the one-shot pulse lengths with a scope, if one is available. This last step is not critical though — you can basically set the unit up just monitoring the video on a monitor screen.

With the settings given previously, you should first of all get a fairly normal-looking picture. Turning the FADE control pot anticlockwise should fade at least a portion of the picture — a rectangle extending from the upper left-hand corner. With the FADE pot turned fully anticlockwise you should end up with that rectangle black, and then by adjusting the FADE/WIPE LEVEL pot you should be able to vary its shade smoothly from black to white, through every shade of grey.

If all seems OK so far, leave the FADE control fully anticlockwise and turn the FADE/WIPE LEVEL control to give a black rectangle, for best visibility. Then you can begin setting the remaining preset adjustments.

First, we need to set RV1 to give the correct delay for the vertical blanking interval. To do this, switch SW2 to the V WIPE position and turn the WIPE pot anticlockwise. As you do so, the black rectangle on the screen will 'shrink' upwards, reducing in height towards the top of the visible image.

Ideally, we want the black rectangle to *just disappear* from the screen, when the WIPE pot is in the fully anticlockwise position. So if it's still visible in this condition, or if it disappears from view long before the WIPE pot reaches the anticlockwise extreme, you'll need to adjust RV1. Turn it anticlockwise to make the black rectangle 'further withdraw', or clockwise if it disappears too soon.

If you have a measuring scope, you can simplify this operation by monitoring the positive pulse width at test point TP1, and adjust RV1 until the pulse measures as close as possible to 1.1ms.

With that setting done, you're ready to adjust RV2 and RV3. This is done by switching SW2 back to the FADE position, whereupon the black rectangle should return to its original size. Then it's a matter of adjusting RV2 and RV3 until it extends down vertically and across horizontally, to *just cover the entire visible picture area*. RV2 controls the vertical scope and RV3 the horizontal scope.

If you have a measuring scope, you can also monitor the negative pulse widths and test points TP2 and TP3. When the preset pot settings are correct these should measure very close to 20ms and 51us respectively.

If you have not fitted capacitor C25 as yet, you might find that the rectangle won't *quite* extend right down to the bottom of the screen, even with RV2 in the fully clockwise position. In that case you'll need to switch off and fit C25, to allow this to be achieved...

That should complete the setting-up of your Fader/Wiper. If you now turn the FADE control clockwise you should see the video image smoothly fading up from black. Switching SW2 to either the V WIPE or H WIPE positions should also allow you to perform smooth vertical or horizontal wipes, using the WIPE control.

All going well, you should now be able to close up the case and fit the assembly screws, so that your Fader/Wiper is ready for use in editing your videotapes. Happy editing! ❖

PARTS LIST

Resistors

(0.25W 1% metal film unless stated)

R1,18	75 ohms
R2	1M
R3,13	1k
R4	10k
R5,17	680 ohms
R6	100 ohms
R7	680k
R8	39k
R9,12	2.2k
R10,11	2.0k
R14,16,21	470 ohms
R15	150 ohms
R19	47 ohms
R20	100k
RV1	10k horizontal trimpot
RV2,3	1M horizontal trimpot
RV4	2 x 100k linear ganged pot
RV5	500 ohm hor. trimpot
RV6	10k linear pot
RV7,8	5k linear pot

Capacitors

C1,2	0.22uF MKT
C3,6,7,11,14, 20,27,28,31	0.1uF monolithic
C4	470 pF ceramic
C5,13	0.1uF MKT
C8	1nF MKT
C9,15,25	10nF MKT
C10	22nF MKT
C12	680pF ceramic
C16	56pF NP0 ceramic
C17	82pF NP0 ceramic
C18	120pF ceramic
C19,26,32	2.2uF solid tantalum
C21,22	220uF 25VW RB electro
C23,29	100uF 16VW RB electro
C24	1000uF 25VW RB electro
C30	0.18uF MKT

Semiconductors

U1	NE5534 op-amp
U2	74HC4066 quad analog switch
U3	74HC00 quad gate
U4	LM1881 sync separator
U5,8	LM555 timer
U6	74HC221 dual one-shot
U7	7805 +5V regulator
U9	7905 -5V regulator
LED1,2	3mm red LED
Q1,2,4	BC548 NPN transistor
Q3	BC640 PNP transistor
D1,2,3	1N4001 power diode
D5,8,9	1N4148 signal diode

Miscellaneous

L1	47uH RF choke
L2	22uH RF choke
SW1	1 pole 4 position rotary switch
SW2	2 pole 3 position rotary switch
SW3	SPDT miniature toggle switch

PCB, 126 x 70mm, code 98vfw4; sloping-front instrument case, 190 x 120 x 65/36mm or similar; two knobs 30mm diameter; four knobs 20mm diameter; two BNC sockets, panel mount; one concentric 2.1mm DC input connector, panel mount; 24 x PCB terminal pins, 1mm; four 3mm x 10mm countersink-head machine screws; eight 3mm nuts; eight star lockwashers.

ALTERNATIVE HEARING MECHANISM DISCOVERED

A researcher in the USA claims to have achieved a breakthrough in hearing research, by discovering a mechanism whereby even profoundly deaf people may be given 'hearing'. It's by ultrasonic stimulation of the saccule, a sensor in our heads previously thought to be involved only in our sense of balance — but known to play a role in the extended hearing of dolphins, bats and other animals...

by TOM MOFFAT

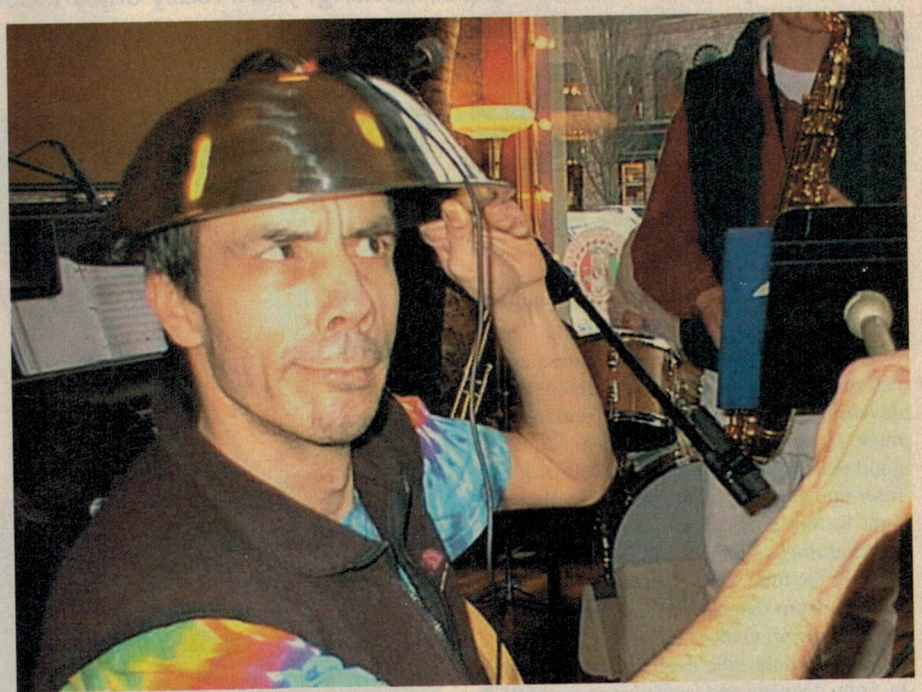
People with hearing problems may no longer need to rely on traditional hearing aids, following the discovery of an entirely new process of 'hearing'. Auditory hearing, as we know it, depends on the fact that the cochlea within the inner ear vibrates in synchronism with sound waves (regular changes in air pressure) impressed upon the eardrum. Because of the physical size of the cochlea and the wavelength of sound, the very best human hearing is limited to frequencies from about 20Hz to 24kHz.

Now a report from the United States says researcher Dr Patrick Funagain has discovered that the human body can detect and respond to a whole new spectrum of audio frequencies, from 28 - 100kHz. These were previously referred to as 'ultrasonic', but now, thanks to a structure within the head called the 'saccule', this whole new frequency range becomes available to human hearing. Even if the cochlea and eardrum combination is totally destroyed, the saccule still works. So, with the help of modern technology, the profoundly deaf should be able to hear once again.

The saccule is a small organ about the size of a pea, filled with a fluid and covered by tiny hairs. If the head is moved around from straight to tilted, the fluid changes position, stimulating the hairs, and a person knows a position change has occurred. So the primary purpose of the saccule up to now has been to aid in maintaining balance, thus allowing a human to walk erect without falling over.

It's been known for many years that animals such as dolphins, bats, and rats have been able to hear well up into the ultrasonic region. Research revealed that the saccule was responsible for this ability. This concept was first expanded upon in an article 'Projections from the Sacculus to the Cochlear Nuclei in the Mongolian Gerbil' (from the *Brain Behav Evol* 1989; 34; 193-200).

This article postulates that the cochlea originally evolved from the saccule, and that the saccule may be used as a primitive hearing organ in lower animals. In fishes, for example, the organ responible for sound perception appears to be the saccule. The authors go on to state that the saccule may have dual auditory and gravity detection functions in the auditory systems of amphibians, reptiles, birds and mammals.



A deaf jazz enthusiast, wearing a prototype headset and holding a microphone, listens to a concert.

With this in mind, Dr Funagain decided to experiment with the human saccule — and sure enough, it could respond to ultrasonic stimulation just like the animal versions. In his earliest trials, Dr Funagain constructed an ultrasonic oscillator which he could tune between 28 and 90kHz. This was amplitude modulated with a normal audio signal, speech or music. The ultrasonic energy was fed to piezo-electric ceramic elements which were pressed against the sides of the head. Test subjects could easily perceive the audio modulation signal, as if it was coming from the centre of their heads.

Early experiments were so successful that they evolved into a commercial product, known as the Neurotone. This device did away with the piezo-ceramic elements, and instead uses electrodes to apply an ultrasonic frequency directly to the skin. The carrier frequency is between 30 and 50kHz, at 3000 volts peak to peak. This system allows subjects to 'hear', even when they are profoundly deaf.

Now it looks like the Neurotone will soon hit the market in a small portable package, similar in size to a Walkman cassette player. This product will be known as the 'Thoughtman'. Early prototypes are said to work very well indeed, although the user must undergo a training program to learn how to decode the audio effectively. It is suggested that novice users should begin with recordings of classical string music, since it has such a wide dynamic and frequency range. They should practice at least one hour every day.

It's not known when the Neurotone Thoughtman will be coming onto the Australian market, but local importers are confident it won't be too long — possibly around the beginning of April next year. ❖

Construction Project:

'TINY TUBE' PORTABLE LIGHTS - 1

The 'tiny tube' is our name for the backlighting lamp used in laptop computer displays. And what a lamp, as you'll read in these articles — which describe three different and very practical lights based on low cost 'disposal' tubes. They are all mains or battery powered, and the light output has to be seen to be believed. If you like hands-on experimenting, you'll really enjoy these innovative and unusual projects...

by PETER PHILLIPS

The lights we're presenting are based on the cold cathode fluorescent tube and reflector-diffuser backlighting assembly from a laptop computer liquid crystal display (LCD) unit. These are available from Oatley Electronics as a disposal item. The LCD itself is not needed in the lights, but if you have a use for it, a data sheet is available. So the whole assembly could be useful.

While there are probably countless applications for the backlight, the three we've developed have all been greeted with amazement by anyone who sees them. And for good reason, as the tube and its reflector-diffuser unit are state-of-the-art. Basically, each light in this project uses some or all of the backlighting system, a simple 12V inverter to drive the tube, and a battery pack (optional) built from disposal NiCad batteries (also available from Oatley).

The backlight tube itself measures 160mm by 5mm diameter and is rated at around 6W. It produces pure white light, for accurate colour rendition from the LCD screen, and has a specified life of over 10,000 hours. The useful surface area of the reflector-diffuser unit is 197 x 150mm. When the LCD is removed, the light from the exposed area is uniformly distributed over the entire surface, rather like a blank white screen on a TV set on maximum brightness. However, there's no flicker and there's also more light output, as virtually all of the light produced by the tube is reflected.

The tube behaves more like a neon than a fluorescent tube, in that it strikes immediately and can be strobed beyond the point where the strobing is visible. When operated without the backplane unit, the tube is extremely bright, despite its small size and power consumption.

So the main advantages of the lights we're presenting are: small size, high efficiency (amazing light output for power input), a pure white light output, and of course a low cost (see end of article for details). As well, each light is made from bits and pieces from around a typical workshop, so the final result is really up to how much you want to put into the construction.

The complete backlighting assembly has many uses, including a light box for viewing colour transparencies. When fitted with the suggested battery pack, it's also a very useful general purpose light.

For example, you could use the backlighting assembly without any dressing up. With about 30 minutes work, you'll have a light you can read by, a light surface for viewing negatives, a troubleshooting light and so on.

The lights

The first light of the three is best described as a light box, and is presented in this article. The second part describes two more lights: a strobe/beacon, and an emergency light.

The strobe/beacon has a 555 timer in the circuit, to give a light that strobes at a rate determined by a front panel control. As you will see in the lead photo, the tube stands vertically. The controls let you adjust the strobe rate and the brilliance. The strobing can be turned off so the light is on continually. The tube sits in a grommetted hole drilled in the top of the box, and has a 200mm lead so the tube can be removed from the box and used as a troubleshooting light in small, hard to get at places. Although we haven't tried it, it's possible that with suitable calibration, this light could be also used as an automotive strobe lamp when tuning an engine.

The emergency light uses various parts of the backlighting assembly, and is mains *and* battery powered. Its main use is an emergency light during a power failure. A relay switches the light on when power fails, and the battery is trickle charged when power is available. This light can also be used for camping (in fact, they all can if you fit batteries), or as a general purpose light.

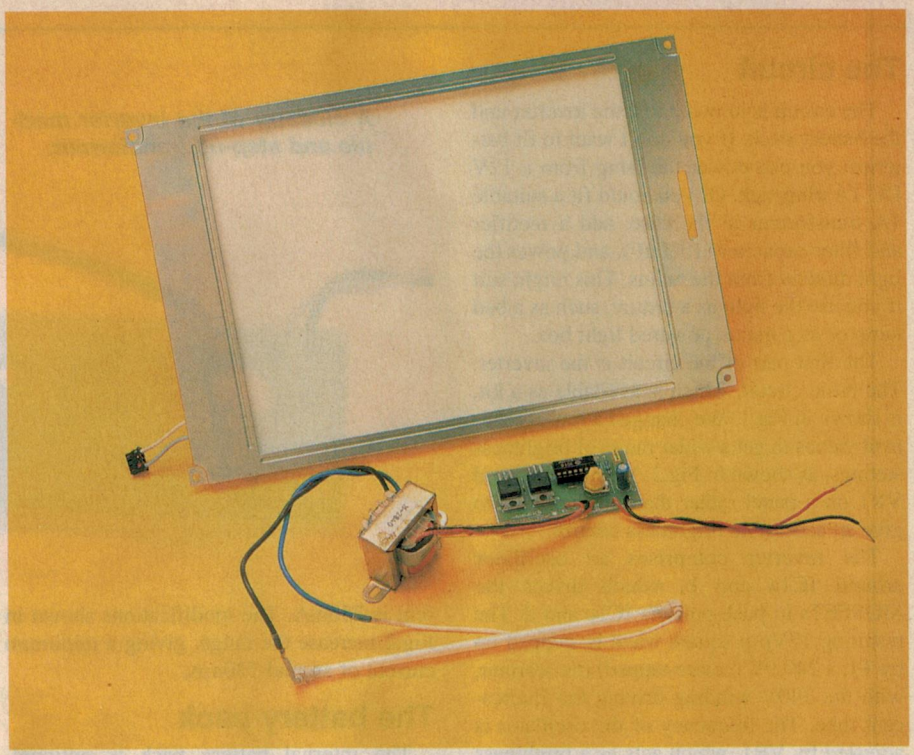
So having whetted your appetite, here's the details of the first of these three very unusual and original lights.

Flat light

This light uses the entire backlighting assembly, with the LCD removed. It makes an ideal light box for viewing transparencies, due to the pure white light output. It's also an excellent general purpose light because it can stand up on any side, lie down, fit under small spaces (eg, under a car) and so on. The light output is enough to comfortably read by, and it lights a room far more effectively than you might think.

Another use is as a lamp when checking on someone who's asleep. This is because the light is diffused over an area, rather than coming from a point source (like a torch). It therefore doesn't disturb someone who's asleep, yet it gives out more than enough light to see by, even when set to its minimum brightness. We changed a few values in the inverter circuit to give a greater range of brightness settings, as we found the original circuit did not dim the lamp sufficiently.

We also made up a battery pack from disposal NiCads, and built this and the charging circuit into the case. The interesting thing is how well everything fitted. As you can see from the photos, there's still plenty of room, yet the case is only 38mm deep.



Shown here is the backlighting assembly, the 'tiny tube' (front) and the inverter.

The case

As shown in the photo, we built a case around the metal frame of the backlight assembly, and then filled, sanded and painted the box to give a good looking, very functional light. The case has printed circuit board for the long sides, and 10mm thick plywood for the short sides. It's all held together with epoxy glue.

To build the case, remove the metal frame from the backlighting assembly, and glue the frame to the sides, which we cut to a height of 38mm. Once the case is finished, the rest of the backlight assembly clips to the metal frame inside the case. We painted the case with automotive spray paint to give a durable, attractive finish.

You might need to cut a relief in the wooden sides for the transformer and the tube connections. The transformer sits nicely in a cutout section of the plastic frame, and is held in place by the back of the case. Incidentally, because the inverter operates at audio frequencies, the transformer produces a just-audible sound at some brightness settings. To reduce this effect, we removed the metal surround from the transformer, and covered the core with epoxy glue. We then wrapped a piece of felt around the outside of the core to help acoustically isolate it from the case.

We made the back of the case from a piece of 5mm plywood, and covered it with felt so the box can be laid on its back without causing scratches. Access to the controls is from the back of the case to give a clear front panel for aesthetic reasons, and to allow large transparencies to be laid on the surface of the light.

We covered the diffuser surface with glass from an old photo frame, to both protect the surface and to give a flat area over the entire front of the case.

PARTS LIST

Inverter

Resistors (all 1/4W)

R1	10k (15k*)
R2	47k
R3	1M*
VR1	50k PCB mount (500k panel mount*)

Capacitors

C1	100uF, 25V electrolytic
C2	4.7nF (or 1nF*) polyester

Semiconductors

IC1	4001 quad CMOS NOR gate
Q1,2	2SK2175 power MOSFETs

Miscellaneous

9V:240V centre-tapped transformer type 2840; backlight tube and assembly as described; PCB 65 x 33mm.
* For modified brightness control

Battery pack

Resistors

R1	6.8Ω, 5W
R2	330Ω, 1/2W
R3	1Ω, 1W
R4	2.2Ω, 1/2W (3 off)
R5	33Ω, 1/2W (3 off)
R6	10Ω, 1/4W (3 off)**

Semiconductors

D1	1N5404 2A diode
D2	1N4002 1A diode (3 off)
D3	1N4148 100mA diode (3 off)
LED	LEDs to suit (3 off)**

Miscellaneous

centre-off DPDT minature toggle switch or equivalent wafer switch; 2.1mm DC power socket; 13.8V 1A DC plugpack; 30 x 63mAh nicad cells, 16 x 48 x 5mm; 2A M25 fuse; scrap printed circuit board as described in text; knob (for VR1); nuts, bolts; hookup wire.
** optional

NOTE: Parts for this project are available from Oatley Electronics, of PO Box 89, Oatley NSW 2223; phone (02) 9584 3563.
Inverter kit with backlight assembly $17, Data sheet for LCD $2, Suitable 13.8V 1A plugpack $10, NiCad cells 30 for $10, Packing and postage charges $6

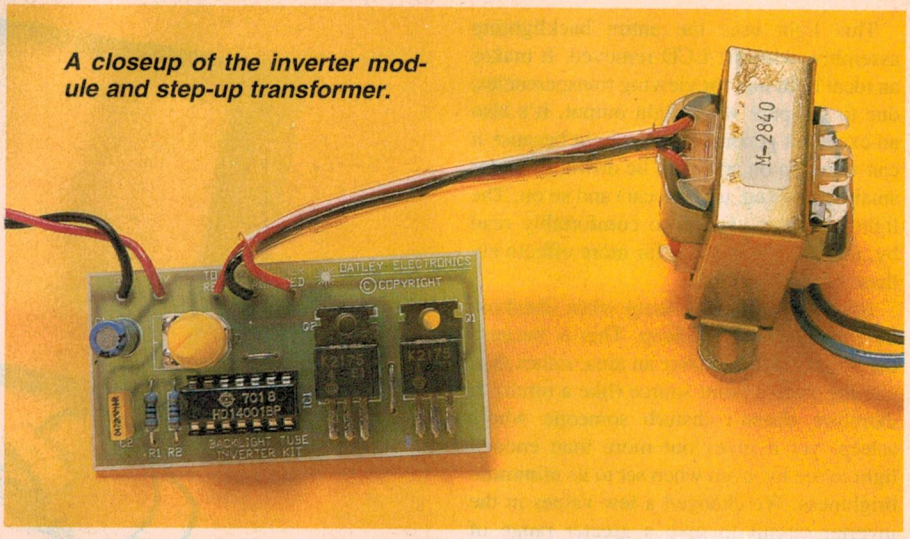
The circuit

The circuit is in two parts: the inverter and the battery pack. If you don't want to fit batteries, you can power the lamp from a 12V DC 1A plugpack. Or you could fit a suitable 1A transformer in the case, add a rectifier and filter capacitor (1000uF), and power the light directly from the mains. This might suit if you use the light as a fixture, such as a bed lamp or as a mains-powered light box.

The first part of the circuit is the inverter. The basic circuit, which is available as a kit, is shown in Fig.1. We changed a few component values to get a wider range of brightness settings, as shown in Fig.2. We also mounted VR1 on a panel rather than on the PCB, to give an accessible brightness control.

The inverter comprises an oscillator around IC1a and b, which drives the MOSFETs in push-pull via IC1c and d. The resulting 12Vp-p square wave is stepped up by T1, a 240:9V (centre-tapped) transformer, with the 240V winding driving the fluorescent tube. The frequency of the oscillator is adjusted by VR1, which acts as a brightness control. Increasing the frequency causes the reactance of the transformer to increase, which in turn limits the tube current.

As a guide, at the minimum frequency, the current taken from the 12V supply is around 500mA. At the maximum frequency the current is 250mA. The modifications shown in Fig.2 increase the range, giving a minimum current of around 120mA.



A closeup of the inverter module and step-up transformer.

The battery pack

The internal battery pack is optional. However it makes the light so much more useful that we've included the circuit and brief details of its construction. The NiCads are available from Oatley Electronics as disposal items and are brand new.

As there's enough room in the case, we made up a battery pack from 30 of these rectangular cells, to give three 12V batteries in parallel. The capacity is around 1.9Ah, enough to operate the light for six hours or more at medium brightness.

The charge and discharge circuit is shown in Fig.3, which we designed to work from a 13.8V DC plugpack available from Oatley Electronics. When supplying a charge current of 150mA or so, the output of this plugpack is around 16.6V, which gives enough headroom to charge the 12V battery pack. The resistor values in the charging circuit are therefore rather critical to ensure a 14-hour charge current for each battery of 40mA. The batteries are trickle charged at 4mA each when SW1 is at position 2 (and the plugpack is connected). Here's the details of the circuit:

When SW1 is set to charge (position 3), current flows from the plugpack through R1 to the rest of the circuit. This resistor has two purposes: to limit the charging current, and to drop the voltage to around 13V when SW1 is at position 1 (light on). We'll discuss this aspect shortly.

Each battery is charged via a 33 ohm resistor (R5) and an isolating diode (D3). The charge and discharge circuit for each 12V battery is identical. The charge current is around

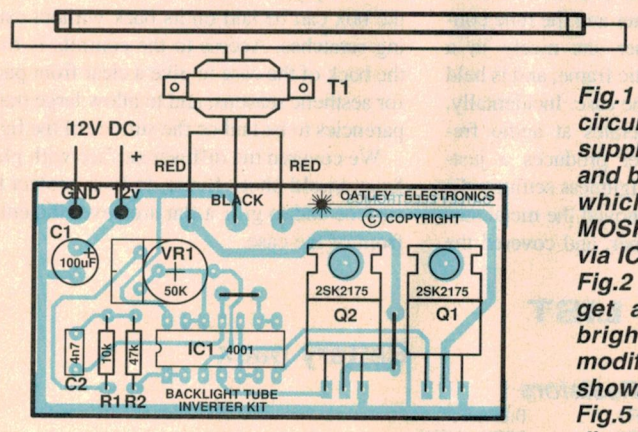


Fig.5

Fig.1 (lower left): The circuit of the inverter as supplied in the kit. IC1a and b form an oscillator which drives the MOSFETs in push-pull via IC1c and d.
Fig.2 (lower right): To get a wider range of brightness settings, modify the inverter as shown in this circuit.
Fig.5 (left): The overlay diagram for the inverter PCB.

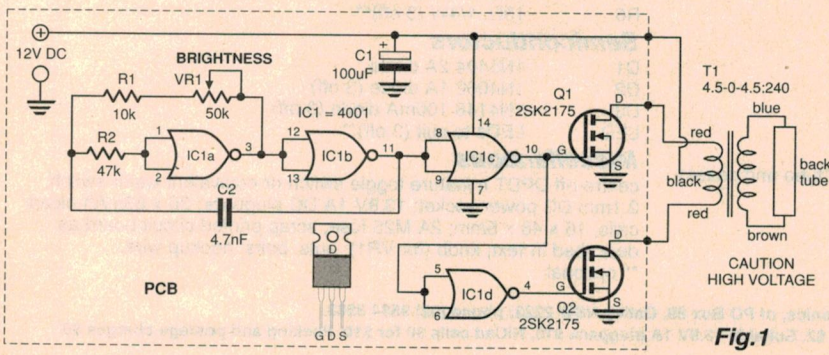


Fig.1

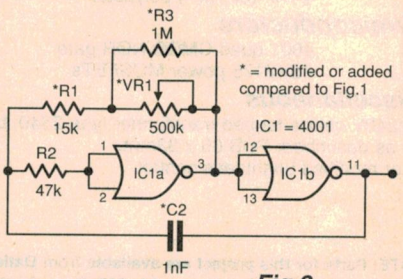


Fig.2

40mA per battery, depending on its state of charge. If the batteries are flat, it will take around 14 hours to fully charge them. After that, set SW1 to position 2, and a trickle charge current of 4mA per battery will flow through R2, keeping the batteries fully charged.

The charge indicator LEDs are optional, and if used can be mounted in either of two ways. The first takes advantage of the cutouts in the backing of the reflector unit. When you examine the backing, you'll see eight rectangular cutouts that are deep enough to take a flat-cased or similar low profile LED. The three charge indicator LEDs can therefore be placed so they are visible through the *front* of the screen. However, you'll only see the LEDs when the batteries are being charged from a state of near discharge, except in total darkness, when they'll be just visible. You can alternatively mount the LEDs in the back of the box.

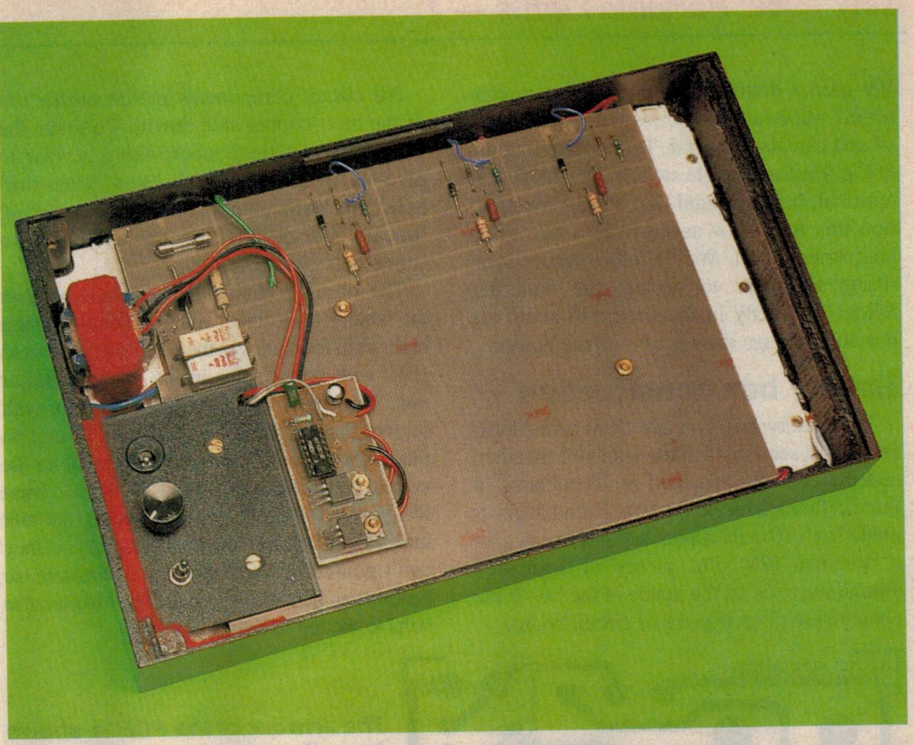
The resistor values are chosen so the LED current is not excessive when the batteries are virtually discharged. After 10 minutes or so of charging, the LED current falls to a few milliamps, enough to cause them to just light.

The discharge circuit of each battery comprises R4 and isolating diode D2. The resistors are needed to ensure equal load sharing of each battery, and the diodes prevent one battery 'charging' another. The value of R4 has been selected to give a nominal 12V supply to the inverter when the tube is at medium brilliance.

When fully charged, each battery has an output voltage of around 13.6V, so if the inverter current is say 300mA, the voltage drop across R4 is 2.2V x 100mA, or 0.22V. The drop across D2 is a volt or so at this current.

When the plugpack is connected and the light is turned on (position 1), both the plugpack and the batteries supply current to the inverter. While this might seem unusual, there's not much we can do about it without adding another switch. It doesn't matter anyway, as the batteries are easily recharged when the light is off by selecting position 3. Resistor R3 further reduces the voltage from the plugpack, and D1 prevents the batteries discharging through the plugpack when the mains power is turned off.

The type of switch for SW1 is up to you.



As this photo shows, everything fits neatly in the light box case. The battery box is held with four screws to the backlight assembly. This box also supports the control panel and the inverter.

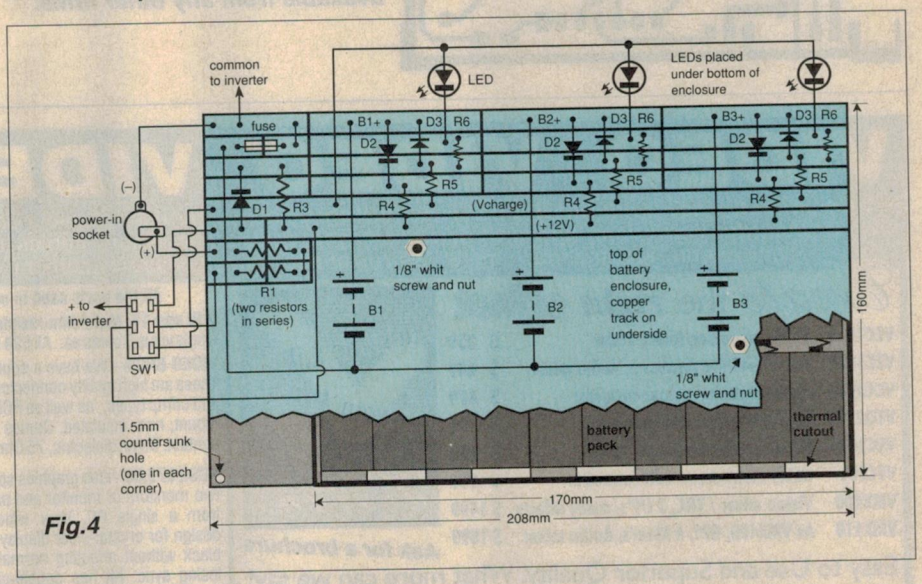


Fig.4

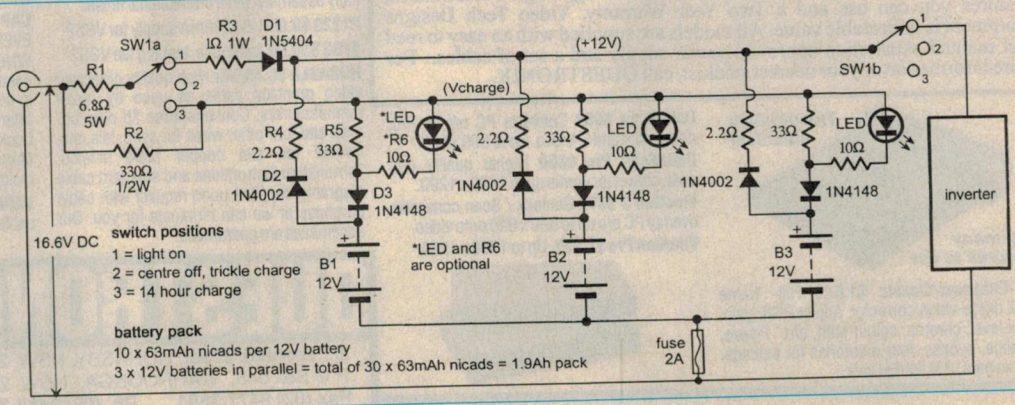


Fig.3: The charge/discharge circuit for the battery pack is shown here. Resistor R4 ensures equal load sharing from each battery, and D2 prevents one battery discharging through another. Each battery is charged via R5 and isolating diode D3. Fig.4 above shows the wiring diagram.

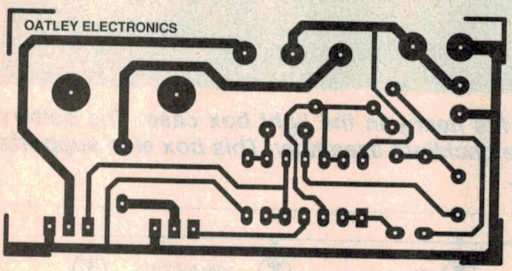
We used a double pole, double throw, centre-off miniature toggle switch, but a rotary switch can also be used. The wiring diagram in Fig.4 is for a toggle switch. The 2A fuse is optional, but we found that during construction this fuse blew several times due to an inadvertent short. We therefore recommend fitting this fuse to protect the batteries. Solder it directly in the circuit, to avoid the possible voltage drop across a fuse holder.

Battery box construction

The battery box is made from printed circuit board sections that are soldered together, and the cells are arranged in 10 columns of three cells each inside the box. Each battery is made from 10 cells connected in series to give a nominal 12V. Put plenty of insulation around the cells, as the inside of the box is the copper side of each piece of circuit board.

All circuit components mount on the top of the box (copper side down). To make the trackwork, cut the copper with a scriber to give the pattern shown in Fig.4. Then drill holes for each component in the resulting 'tracks'. Check carefully that there are no shorts between each track.

The top and bottom of the box are larger than the battery enclosure, which is around 10mm high. Drill four holes in the bottom of the box to align with screw holes in the plastic reflector unit. The box is then held to the reflector with screws that originally held the LCD unit in place. On the top of the box, bolt a panel for the switch, brightness control (VR1) and a 2.1mm DC power socket. If you are making the unit into a light box, mount these controls so they don't protrude beyond the back of the case, so the box can lie flat on its back. The inverter also bolts to the top of the battery box.



The artwork of the PCB is shown here if you want to make your own. The artwork is copyright to Oatley Electronics, and won't be available from any other firms.

Other uses

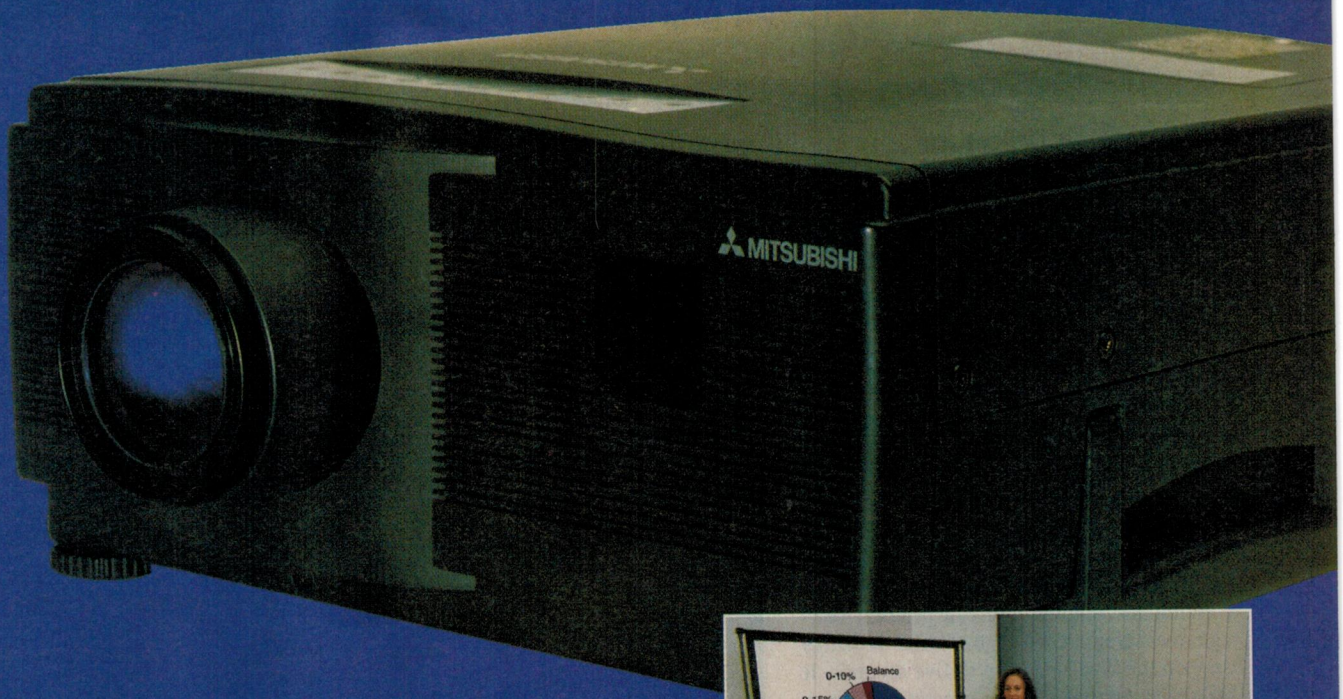
This lamp is perhaps the most unusual of the three we're describing. Suggestions from those who have seen it include using it as a tabletop light in a room decorated with contemporary furnishings. It's up to your patience and skill as to how good it looks, which is best achieved by careful filling and sanding to remove all gaps in the case. We found epoxy glue to be the strongest and most reliable filler.

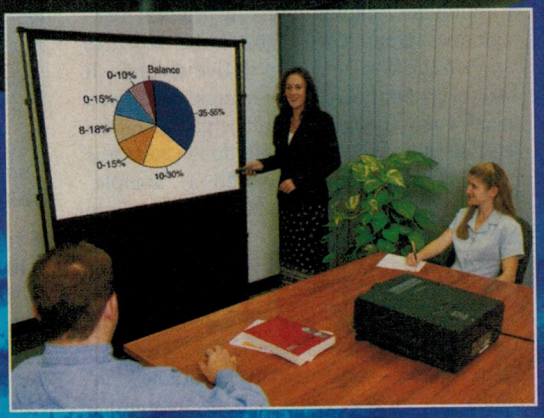
To get the longest battery life when the lamp is used as a camping light, set the lamp brightness to the lowest practical setting for the conditions. By modifying the resistor values in the charging circuit, it might be possible to charge the NiCads from a car cigarette lighter socket, providing the car's engine is running. As already mentioned, when charged, the NiCad battery pack produces around 13.6V. The output of a car alternator is about a volt higher, but it might still be sufficient to allow it to charge the NiCads. If not, use nine rather than 10 cells in each battery.

No doubt there are many more uses for this light, as there's really nothing quite like it on the market. We'll leave it to your imagination.

(To be continued) ❖

Make presentations in a new light...





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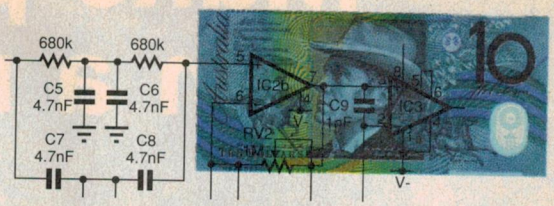


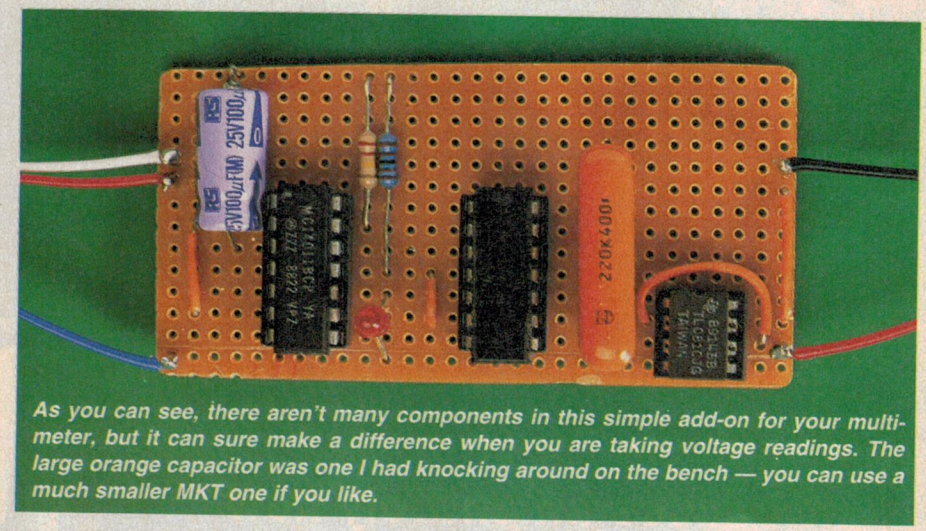
by OWEN BISHOP

Sample-and-hold adapter for multimeter

This useful add-on for your multimeter allows you to sample a voltage and hold the reading steady while you jot down the figures. It works just as well with an ordinary moving-coil meter as with one of the digital variety. Sampling is automatic in this version of the circuit but it is easy to adapt it to sample whenever you press a button.

Modern fancy digital meters often come with a 'freeze' or sample and hold function, where the meter's reading is frozen on the display when you press a button. This helps you if you are in a situation where you can't keep your eyes on both the test probes and the meter's display at the same time. All very well if you have a fancy meter, but if you only have a simple digital meter (or even an older analog one) you'll have to go without — unless you build this sample and hold adapter, that is!

With this adapter, you can perform voltage measurements and have the readings stay on the display for up to five seconds. It will even automatically re-sample, so all you need worry about is getting the probes on the right spot and the meter will do the rest. It is also a simple matter to add a 'Sample' switch so you can manually sample only when you want to.



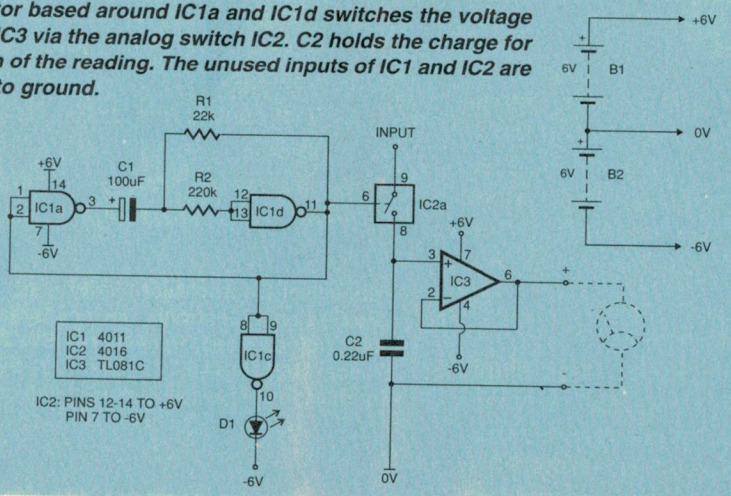
As you can see, there aren't many components in this simple add-on for your multimeter, but it can sure make a difference when you are taking voltage readings. The large orange capacitor was one I had knocking around on the bench — you can use a much smaller MKT one if you like.

How it works

The circuit is driven by a clock with a period of about five seconds. This is a well-tried module built from two inverting logic gates. You can see in Fig.1 how we use a pair of two-input NAND gates (IC1) with their inputs wired together to make a pair of inverters. Because we are only using them as inverters, you could use NOR gates instead if you happen to have a spare 4001 instead of a 4011. A third gate from the same IC is used to drive a LED (D1), which indicates the state of the clock.

The input voltage is applied to the input of the analog switch IC2a. Think of this as a voltage-controlled switch. It is an analog switch because, unlike other logic ICs, which produce only logical high and low levels, the 4016 will pass any voltage between these extremes.

The oscillator based around IC1a and IC1d switches the voltage through to IC3 via the analog switch IC2. C2 holds the charge for the duration of the reading. The unused inputs of IC1 and IC2 are connected to ground.



When the control voltage from the clock is high the switch is ON. It then acts as a resistor of about 300Ω between the input and the storage capacitor C2. 300Ω is a fairly low resistance, so it takes only an instant for the voltage across the capacitor to come to the same value as that at the input. From then on, the voltage on the capacitor follows the voltage at the input.

When the control voltage goes low, however, the analog switch turns OFF. It now presents a very high resistance, isolating the capacitor from the input. Charge can't leak away from the capacitor to any appreciable degree because (1) the analog switch has high resistance; (2) the capacitor has a high insulation resistance and (3) the input to the op-amp (IC3) also has a high resistance. We have used a TL081C op-amp, which has an input resistance of about $10^{12}\Omega$, so leakage through this path is negligible.

The op-amp is wired as a voltage follower, which produces a voltage on its output equal to the voltage on its input. By using a voltage follower we can accurately read the voltage on the capacitor by simply attaching a multimeter to the output of the op-amp.

The voltage follower configuration is one of the simplest ways of using an op-amp, but one that has many applications. You will come across this time and time again in cir-

cuits of many different kinds, so it is a good idea to know how it works. It relies on three properties of op-amps, one of which we have already mentioned. This is the fact that op-amps have a very high input impedance, which means that they draw very little current from anything to which they are connected. In this case the IC takes virtually no charge from the capacitor.

The second property of op-amps is that they have a relatively low output resistance, so the IC can provide ample current to drive the meter in this application.

The third property is that, when connected with feedback from the output to the inverting input, the output voltage always tries to keep both inputs at the same voltage. If the voltage at the non-inverting (+) input rises or falls, the op-amp tries to make the voltage at the inverting (-) input rise or fall too, by the same amount. It does this by increasing or decreasing the output voltage, which is fed back to the inverting input.

Since there is no resistor in the feedback path in this circuit, the only way this can happen is if the output voltage changes to match the input voltage exactly. In summary, the output voltage equals the voltage on the capacitor and the op-amp provides enough current to drive the meter without removing any significant amount of charge from the capacitor.

Note that the circuit has a dual power supply, consisting of two 6V batteries. The measurable range of input is limited only by the swing obtainable from the op-amp, which is to within about 1 volt of either power rail. CMOS has a maximum operating voltage of 15V, but some references quote 18V as the absolute maximum, so it is possible to use a pair of 9V batteries if a wider range is essential.

Construction

Use two battery clips for a pair of 9V batteries, or two battery boxes each containing four 1.5V cells as a dual 6V supply. The circuit is built on a small rectangle of stripboard (Fig.2), and you're probably best off building the clock and its LED first. Note that several of the pins of the IC socket can be joined to adjacent pins by solder blobs, and that the strip is NOT cut at M7 below IC1.

If you would prefer a different clock rate, calculate values for C1 and R1 using the equation:

Frequency = 2.2RC

then make R2 equal to about 10 times R1.

When power is applied the circuit oscillates at about 0.2Hz, with the LED spending about equal lengths of time on and off. Note that the input to the unused gate of IC1 (pins 5 and 6) are connected to the output at pin 13, to conform with the rule that all CMOS inputs must be connected to something.

There's almost no wiring around IC2, since almost all the connections can be made with solder blobs. We are using only one of the four transmission gates of this IC, which seems wasteful, but in practice this is simpler and no more expensive than using a JFET. It also gives us a spare gate, which we can put to use later on.

When IC2 is assembled, test the circuit by setting up a variable voltage source, using a pot wired across the supply lines (Fig.3). Monitor the output at pin 8 of IC2. You will see the output voltage coming to the set level every time the LED goes out, but falling pretty sharply to zero as the LED comes on. This is because the stored charge rapidly leaks away through the meter.

Finally, assemble C2 and IC3. The output at pin 6 (N29) follows the voltage at the wiper of the pot whenever the LED is out. When the LED switches on (hold) the output remains steady, even if you change the setting of the pot. When the LED goes out again, the output immediately swings to and follows the present input level.

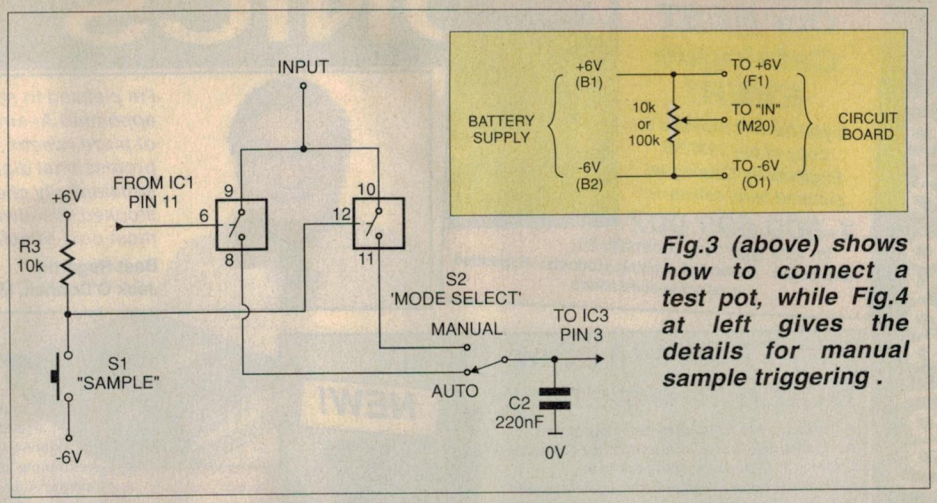


Fig.3 (above) shows how to connect a test pot, while Fig.4 at left gives the details for manual sample triggering .

Manual operation

We have some analog switches (or transmission gates as they are sometimes known) left over with the above design, so a manual option can be added at almost no extra cost. There is room to include the wiring at the top right-hand end of the board.

We use the gate with terminals at pins 10 and 11, and with its control input at pin 12 (Fig.4). Pins 9 and 10 are joined by a solder blob so we have a single connecting link to the test-point, and a SPDT switch selects whether we are using automatic or manual sampling. Normally, the control input is held high by the pull-up resistor R3 keeping the switch on. Pressing the button pulls the control input low, so turning off the switch. This samples the input voltage and holds it until the button is released. ❖

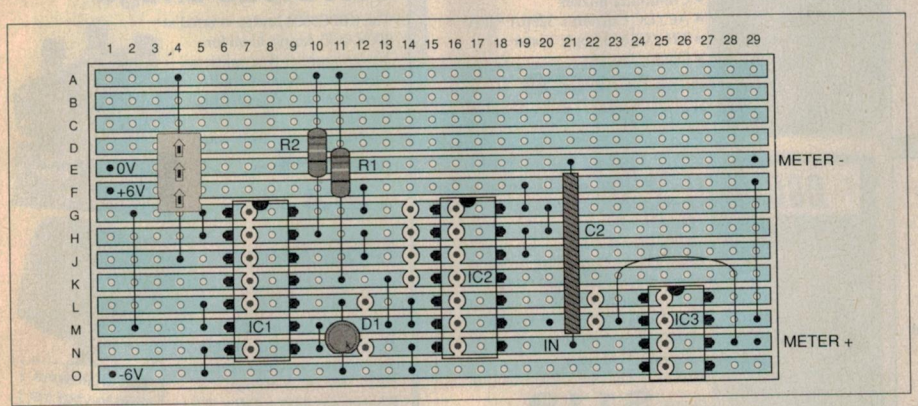


Fig.2: The overlay diagram for the Sample-and-hold adapter. While links are shown here for clarity, a lot of the connections could be made with solder blobs on the copper side of the board.

PARTS LIST

Resistors

(All 5%, 0.25W)

R1	22k
R2	220k

Capacitors

C1	100uF axial electrolytic
C2	0.22uF polyester

Semiconductors

D1	LED (any colour)
IC1	4011 CMOS quad NAND gate
IC2	4016 CMOS quad analog switch/multiplexer
IC3	TL081C op-amp

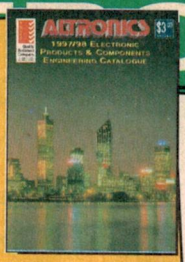
Miscellaneous

Stripboard 37mm x 74mm (14 strips x 29 holes); 6 x 1mm terminal pins; 2 x 14-pin IC sockets; 8-pin IC socket; 2 x battery clips or battery boxes.

ALTRONICS COMPONENTS

ALTRONICS Fax Order Line: (08) 9328 3487

Our BEST Catalogue EVER!

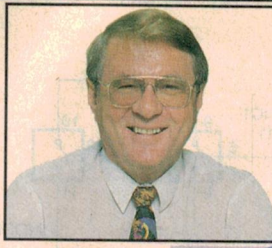


If you haven't received a copy of our 1997/98 Engineering Catalogue, pictured here, call us on

1-800 999 007

for your *free* copy (normally $3)

• 212 pages • Dozens of exciting products • Expanded product specifications



I'm pleased to announce that Altronics has recently been appointed Australian distributor for the fantastic LeSon range of piezo tweeters from Brazil, and the fabulous range of UpTeK professional digital multimeters. These products are substantially cheaper than similar products we have previously stocked. It's always our aim to provide our customers with the most cost-effective and up to date products available.

Best Regards,
Jack O'Donnell, Managing Director

High Power LeSon Piezo Dome Tweeters

NEW!

Altronics is proud to have been appointed exclusive distributor in Australia for the famous LeSon range of piezo dome tweeters. Manufactured in Brazil to stringent specs and QC, these are standard issue to several USA loudspeaker system makers of renown. In our opinion LeSon offers superior performance, SPL and value than our previous Motorola units.

Rectangular 230 x 125mm Horn Tweeter
200W Max Power, 105dB @ 2.83V/1m
C 6175 **$39** ea, or **$35** ea 4 & up

Phase Aligned 174 x 130mm Cluster Tweeter
MASSIVE 400W RMS POWER HANDLING!
400W RMS Power, 105dB @ 2.83V/1m
C 6180 **$89** ea, or **$80** ea 4 & up

Round 63mmØ Polycarbonate Dome Tweeter
150W Max Power, 108dB @ 2.83V/1m
C 6205 **$19.95** ea, or **$18** ea 4 & up

Round 74mmØ Polycarbonate Dome Tweeter
200W Max Power, 108dB @ 2.83V/1m
C 6215 **$29.95** ea, or **$27** ea 4 & up

PC FM Radio Receiver

FEATURED IN SILICON CHIP MAY '97 SHOWCASE!

Turn Your PC Into a FM Radio! Simple "Plug-In" Installation.

A plug-and-play FM broadcast band receiver for your multimedia PC! Plugs into the RS-232 serial port (DB25), and has an audio output which connects to your PC's sound card. The Windows-based tuner includes memories for your favourite stations, seek tuning and even a frequency display! Once tuned, the radio will operate in the background while you use the computer for other tasks. The software can be closed while the radio continues playing, saving RAM. Package includes radio module, stereo 3.5mm jack audio lead, antenna and software. No external power required, covers 87.5MHz to 108MHz FM band. 40mV rms output at 60dB S/N ratio. Requires 386SX or better CPU, sound card and Windows 3.1/'95 OS.

A 0900 Normally $49.95, NOW **$35**

Universal Cable Checker

Similar commercial units sell for more than $200! Build your own and SAVE HEAPS!

EXCLUSIVE TO ALTRONICS! Attention musos, roadies, installers, and enthusiasts! Here is a great piece of test gear, a Universal Cable Checker. Make sure that your cables are in good shape before a gig or installation. Checks continuity of: • 3-pin XLRs • Mono & stereo 6.35mm jacks • Stereo RCA leads. • Push-to-test operation. A tricolour LED display shows the status of each conductor of the lead, so if a short or open circuit exists, you know just where it is! Also has low battery and out-of-phase indicator for checking balanced leads. Supplied with silk screened and punched front panel, available in kit or fully built form. Requires 9V battery (not included).

K 2569 Kit Version **$69**
Q 2590 Built and Tested Version **$139**

UpTeK Professional Digital Multimeters

Altronics has been appointed Australian distributor for this fine range of UpTeK digital multimeters. These superb meters are ideal for the hobbyist and professional alike. All feature UL approved fuse protection on current inputs, large high contrast 3.5 digit LCD displays, high quality instrument leads, built-in stand and rugged construction. If you want the best performing multimeter for your dollar, then look no further than these excellent instruments.

All are supplied with high quality, silicon rubber insulated instrument test leads.

Note: Q 1115 rubber holsters pictured are available in yellow only, and are sold separately for $12.95 ea.

NEW!

Each UpTeK DMM is backed up by a *3 Year Warranty!*

43 Range LCR DMM
- 20MHz Frequency Counter
- Incorrect Lead Socket Beeper
- Peak Hold & Data Hold
- Auto Power Off
- Inductance < 2mH - 20H
- Capacitance < 20nF - 2000µF
- Frequency < 2kHz - 20MHz
- AC Volts < 200mV - 750V
- DC Volts < 200mV - 1000V
- Resistance < 200Ω - 20MΩ
- Continuity Buzzer
- AC/DC Current < 200µA - 10A
- TTL/CMOS Logic Tester
- Diode Check

Q 1108 **$149**

Auto Ranging DMM
- 32 Segment Bar Graph
- Manual Override of Auto-ranging
- Incorrect Lead Socket Beeper
- Range Hold & Data Hold
- Auto Power Off
- AC < 320mV - 750V
- DC Volts < 320mV -1000VDC
- Resistance < 320Ω - 30MΩ
- Continuity Buzzer
- AC/DC Current < 320µA - 10A
- TTL/CMOS Logic Tester
- Diode Check

Q 1104 **$129**

30 Range DMM
- Temperature -50°C to 1100°C
- Data Hold
- Auto Power Off
- AC Volts < 200mV - 750V
- DC Volts < 200mV - 1000V
- Resistance < 200Ω - 20MΩ
- Continuity Buzzer
- AC/DC Current < 200µA - 10A
- Diode Check

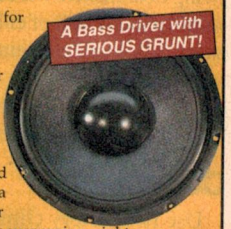
Q 1102 **$109**
Q 1103 Thermocouple **$15**

***TRUE RMS* 34 Range DMM**
- True RMS AC measurement to 5kHz
- Frequency Counter < 2kHz - 20MHz
- Data Hold
- Auto Power Off
- Low Ohms Capability (< 20Ω)
- Zero Adjust on Low Ohms
- AC < 200mV - 750V
- DC Volts < 200mV - 1000VDC
- Resistance < 20Ω - 20MΩ
- Continuity Buzzer
- AC/DC Current < 200µA - 10A

Q 1106 **$119**

BONUS THIS MONTH! Purchase any one of these excellent digital multimeters, and receive a shock-proof rubber carry holster, valued at $12.95, absolutely ***FREE!!***

12" PECC Woofer



A Bass Driver with SERIOUS GRUNT!

A serious bass driver for producing mind-bending bottom end! Ideal for use with our LeSon tweeters to make your own DJ bins or high power speakers. Features Poly Emulsion Coated Cone (PECC) for extra rigidity, nitrile rubber surround, long-throw suspension, eight-screw gasket and massive 1.4kg magnet. **Max Power:** 160W, **Impedance:** 8Ω, **Freq. Response:** 25Hz - 3kHz, **Qts:** 0.22, **Vas:** 289 litres.

C 3030 Normally $169, NOW **$129**

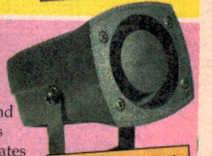
35A Diode Bridge

The KBPC3504 bridge is rated at 400V @ 35 Amps. Ideal for power supplies & amplifiers. Has a metal case for bolting to a heatsink and solder lug connections.

Z 0091 Normally $6.15 each, NOW **$4** ea, or **$3** ea 10 & up

Ideal for Power Supplies, Power Amps etc

Mini Siren



Makes an absolute din for such a tiny siren! Includes metal mounting bracket and fly lead connections. Blasts out 105dB at 1m, and operates off 6 - 16V DC @ 300mA. *Dimensions 40W x 44H x 57L.*

S 6120 Was $18.85, NOW ONLY **$12**

Add an internal siren to your car alarm! Can even be hidden on motorcycles!

ALTRONICS **1-800 999 007** PERTH (08) 9328 1599

OVERNIGHT DELIVERY

Weather Proof Sound Monitor Speaker Kit

What A Great Idea!

This kit includes everything you need to construct your own pair of weather proof monitors! They're fantastic for patios, pool sides, games rooms and extension speaker applications. Kit consists of ABS housings, end caps, baffles, 100mm *weather-proofed* drivers, screws and connection cables. All you'll need to build them is a screwdriver, soldering iron and a tube of silicon sealant or similar.

Don't pay hundreds of dollars for expensive imported monitors! Build your own and save!

CX0910 Only **$79** a pair

Enjoy your sound system outside! Build your own set of weather-proof monitors!

Includes the Famous Wacki Bracket for easy mounting!

Learning IR Remote Control

with *LCD Backlit Touch-Screen*

Are you sick of having remote controls all over the coffee table? Always picking up the wrong one? This *learning* remote control can replace up to eight remote controls! It features a multi-function ***touch sensitive backlit LCD*** screen that displays a range of function buttons to match the selected mode. Featuring 8 different appliance modes, it can control TV, VCR, CD, LD, AMP, TAPE/TUNER. It also has two auxiliary modes SEL1 and SEL2, which can each be configured as a TV, VCR, CD, LD, AMP, or TAPE/TUNER device. When you select a mode, the unit changes the buttons on the display to mirror the typical controls of the selected device. AMP mode even includes Surround Sound channel adjustment buttons. The unit is programmed from an original, working, remote. Also features backlighting (unlike others on the market) which is essential in darkened rooms. It's light sensitive, so the backlighting only activates in rooms with low light levels (saving batteries). Once activated, the backlighting stays on for about five seconds, and then dims off. Requires 4 x AAA batteries (supplied).

A 1000 Normally $239, *APRIL SUPER SPECIAL* **$199**

Get rid of your coffee table remote clutter with this amazing unit!

SAVAGE Discounts on Instrument Cases!

As a result of a huge scoop purchase, Altronics can now offer these cases to you at rock bottom prices!

As used in many EA and SC kit projects and by many major manufacturers Australia wide, these instrument cases are moulded from ABS plastic and feature internal mounting posts, PCB guide rails and vent slots. Attractive textured finish, with removable black front and rear panels. • Very easy to drill and machine • Requires no painting • Panels can be direct machine engraved or silk screened. **Available in light grey or black.**

Small Case Dimensions - 200W x 155D x 65H mm

H 0480F Light Grey Case **H 0481F** Black Case

Normally $13.95 ea, **This Month $9**, or 4 & up **$7.50** ea

Large Case Dimensions - 250W x 190D x 80H mm

H 0482 Light Grey Case **H 0483** Black Case

Normally $17.50 ea **This Month $12**, or 4 & up **$9.50** ea

At These Prices, Why Not Stock Up for Future Projects?

Toroidal Transformers

We've got a ***strictly limited*** quantity of these high quality toroids to clear! They're as used in many of our own kit projects and products. Selected voltages available, but be very fast, these will go quickly!

TOROIDAL SELLOUT! SAVE OVER 35%!

M 4008 50VA 9V+9V Was $29.95, NOW **$19**

M 4025 50VA 18V+18V Was $34.95, NOW **$22**

M 4065 160VA 30V+30V Was $49.50, NOW **$30**

M 4036 300VA 18V+18V Was $67.50, NOW **$40**

M 4105 300VA 45V+45V Was $67.50, NOW **$40**

M 4120 500VA 30V+30V Was $115, NOW **$79**

M 4145 500VA 55V+55V Was $115, NOW **$79**

M 4155 500VA 65V+65V Was $115, NOW **$79**

1N4004 Diodes

1/2 Price!!

HUGE discounts on general purpose rectifier diodes in packs of 100! Rated at 400V @ 1A. Stock up your parts bin with these popular devices and ***save 50%!***

Z 0109 Normally .15¢ each,

NOW **$7.50** per 100

Micron Desoldering Tool

Desolders a 14 pin IC in around 30 seconds!

The T 1280 makes it a breeze to remove components from any PCB, even double sided, through-hole plated boards. All it needs is a squeeze or two on the trigger and the component virtually falls out. **Features:** • Totally self contained • Light and compact • Anti static tip • Safe & easy to use • Simple to clean and maintain • Variable tip temperature. The ***Sure Shot*** generates a high speed vacuum every time the trigger is squeezed. This vacuum sucks the molten solder into the collection reservoir of the unit. Here the molten solder solidifies into small particles.

Replacement Tips

T 1280 Was $349

T 1282 1.0mm Tip **$34.95**

NOW **$299**

T 1283 1.6mm Tip **$34.95**

Now over 1500 units in service Australia wide!

TERRIFIC BONUS OFFER!

The first 50 callers to purchase a T 1280 receive a T 1274 Bench Stand , valued at *$24.95*, ***FREE!***

The T 1274 keeps your desoldering tool safely upright on your workbench and shields the hot element!

Micron Pro Series Soldering Station

Low voltage iron handpiece for use with Microprocesor or Sensitive Digital Circuits!

Features ceramic element with embedded thermocouple for ultra-fast heat recovery. Ideal for the hobbyist or professional!

The ultimate in controlled temperature hand soldering for hobbyist and professional applications. Features **• Huge 60 watt heavy duty element** • Dial up temperature control with ±1°C stability at idle • Temperature range 250°C to 450°C • Ceramic heater element with embedded thermocouple for ultra-fast heat recovery • Zero voltage switching to minimise voltage spikes at tip • Low voltage element for added safety • Built in sponge tray with tip cleaning sponge • Full range of replacement long-life tips • CMOS-safe grounded tip

T 2441 Normally $199,

NOW ONLY **$149**

BONUS DEAL!

With every Micron soldering station purchased during our sale, we'll throw in a T 1100A roll of solder, and a T 1230 Solder braid twin pack, normally valued at **$13.45** ***FREE!***

Battery Backup Siren

Incredibly loud 120dB siren with internal battery backup. The brown and white trigger wires are joined to form a "tamper loop", which is connected to a house or car alarm module siren output. If either of the trigger wires or the power wire are cut or disconnected, the siren will sound. Internal batteries can be switched off via a keyswitch on the siren.

S 5208 Normally $55, NOW **$39**

Be Quick! *25 ONLY!*

LCD Panel Meter

This well designed LCD module will take care of most of your requirements of digital voltmeter displays. Ranges and decimal place options are easily configured by PCB links. Small, compact, reliable and comes complete with plastic surround for a professional finish.

Ranges:.....200mV, 2, 20, 200 1000 VDC

Input Impedance:.....10MΩ

Power Supply:.....9V DC

Q 0560 Normally $45, NOW **$25**

SAVE OVER 20%! Add a hi-tech touch to your power supply, instrument panel etc!

"Easy Start" Jump Starter

Have you ever returned to your car to find a flat battery because you left your lights on? This magic box can have you up and running in about 5 mins without you even lifting your car's bonnet!

One end is plugged into the "good" car's socket, whilst the other end goes into the "flat" car's socket. The "good" car is then started and run for about 5 mins, after which the "flat" car should start. It's clean, easy to use and a lot less intimidating than a sparking set of high current jumper leads. It is also safe for use on EFI equipped cars, (jumper leads can cause expensive damage to engine management systems). Fits in the glove box or under a seat, full instructions included.

A 0295 Normally $39.95, NOW ONLY **$19.95**

Jump start your car without even lifting the bonnet!

300W Inverter

Connect this to your car or boat battery and presto - instant 240V mains power for electrical appliances. Suitable for drills, lights and power tools etc. Includes an on/off switch and a light & heavy load switch with metered output.

Includes heavy duty battery leads!

M 8120 Normally $249

Now **$199**

SAVE $50! Fantastic for Farming, Boating, Camping etc.

LIMITED QUANTITY at this INSANE price!!

ALTRONICS Fax Order Line: (08) 9328 3487

1-800 999 007 **PERTH (08) 9328 1599**

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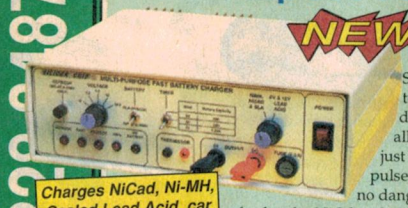
ALTRONICS COMPONENTS

ALTRONICS Fax Order Line: (08) 9328 2187

Multi-Purpose *Fast* Battery Charger Kit

NEW!



A complete battery charger! Using the new, high-tech Philips TEA1102A Battery Management IC, this versatile unit charges NiCad, Nickel Metal Hydride, Sealed Lead Acid, car and motorcycle batteries from 1.2Ah to 4Ah in 6, 7.2, 9.6, 12 and 14.4V terminal voltages. It even does power tool and R/C model battery packs! Best of all, it's super fast, and can charge a 1.2Ah battery pack in just 15 minutes! The batteries are kept topped up using pulse-trickle charging once they're up to full charge, so there's no danger of overcharging your batteries. It also features a refresher for NiCd and NiMH batteries, under and over-temperature cutout, short circuit battery protection, timeout and fuse protection and LED charge indicators.

Charges NiCad, Ni-MH, Sealed Lead Acid, car and motorcycle batteries up to 4Ah!

BEWARE OF INFERIOR KIT SETS! *The Altronics K 1670 is includes a professional instrument case, including fully silk-screened and punched front & rear panels. PLUS, we've specified a low-radiation, high efficiency toroidal mains transformer.*

K 1670 **$199**

New design features the latest Motorola high power output transistors!!

HUGE 500W! Great for DJ amps, component subwoofers, instrument amplifiers, even PA systems!

500W Amplifier Module Kit

What a Beast! 500W into 4Ω!

(See SC Aug '97) Just the thing to power dedicated subwoofers, DJ, PA or party amps or the like. Silicon Chip claims it's the biggest amplifier ever published in a magazine and they'd be right. *Features* • 500W RMS into 4 ohms , 278W into 8 ohms (-0.3dB @ 20hz and 20KHz) • Input sensitivity 1.43V (at full power into 8 ohms) • Distortion typical less than 0.01% • Signal to noise 117db unweighted 122db A-weighted • Supplied with the PCB and the components to populate the board, requires a heatsink and power supply (*requires ±80V DC*)

K 5190 **$230**

12V Halogen Discolight Kit

Great for car shows, sound-offs, shop displays etc! A safe, low voltage light display!

(See SC Jan/Feb '98) Based on the original Silicon chip Discolight, this unit offers the same features as the mains version only with low voltage rails , making it ideal as a school project or to add something different to your car at the next car show or auto salon! Supplied with an attractive case with pre-punched and screened front panel and parts to build and power the unit off 12V DC (*halogen lamps not supplied*). **Features:** • 4 channels (20W or 50W halogen lamps) • Forward, reverse and auto reversing chaser patterns with music modulation • Simultaneous strobe on all channels • Alternating light patterns • 12V DC or AC operation • Input from loudspeakers, aux level or mic .

Sustain Unit Kit for Electric Guitars

NEW!

Add sustain to your range of guitar FX at a fraction of the cost of a commercial unit!

(See SC Apr '98) A sustain unit can make your guitar sound a little more "live", by keeping the volume of a note at a constant level while the string resonance dies away. It's one of the most widely used guitar effects (FX), and this simple kit is a fraction of the cost of a commercial unit! It features adjustable attack and decay, a defeat switch and standard 6.35mm input/output jack sockets. Requires a 12V DC power supply. Supplied short form so you can build it into a custom case, if required.

K 5539 **$27.95**

JFET Direct Injection Box Kit

NEW!

A simple, phantom-powered DI box with super low noise JFET mixer!

(See EA Apr '98) DI Boxes allow you to feed the output from a musical instrument directly into an amplifier without using a mic. This new improved DI unit uses a single JFET amplifier, driving a line balancing transformer, and operates from a mixing consoles phantom power system. It has extremely low noise characteristics, high common-mode rejection and wide dynamic range. It features a 6.35mm jack input, a 6.35mm "loop out" for an instrument amplifier, and a balanced 3 pin XLR output for connection to the mixing desk.

K 5552 **$49.50**

Video Fader Kit

NEW!

Add professional wipes & fades to your home videos! Even includes an enhancer to boost the edited signal!

(See EA April '98) Got some home videos you'd like to edit properly for keeps? This useful kit allows you to add basic professional video effects such as horizontal and vertical wipes, fade-ins and fade-outs during your editing. It also includes a built-in switchable signal enhancer so you'll maintain a high picture quality during the process. You'll be surprised just how professional-looking your results can be simply by using this very easy to build kit! Powered by 12VDC plugpack.

K 5875 **$65**

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NEW!

Locate cable breaks in seconds!

(See EA Feb '98) This cable break finder kit allows you to locate the discontinuity in a length of cable without cutting off inch-long sections of cable looking for it! The lead is simply plugged into the unit's sockets, then the dial is rotated until the LED lights. You can then read the location of the break, expressed as a percentage of the cable's length, off the dial. Dead easy! Tests 3 pin XLR, 6.35mm mono and RCA cables. Powered by 9V battery (not included).

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(See SC Nov '97) A simple little kit that can add a touch of interest to your doorbell! It can be "programmed", by setting resistor values, to play a sequence of nine notes when the doorbell is pushed. Kit includes PCB, components, loudspeaker and pushbutton switch for the door button, or you may like to use your standard door bell switch if you have one already! It's powered by a 9V battery or DC plugpack (not included).

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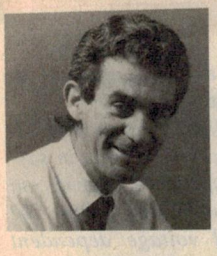


INFORMATION CENTRE

by PETER PHILLIPS

Model T computers, the Firewire interface & voltaic LEDs

We start with a simple analogy that might prove useful when you're explaining to a non-technical person why computers are still so unreliable. Other topics include a description of a new, very fast serial data system and a simple temperature controller circuit. We also examine a linear circuit whose input impedance changes with the supply voltage, and look at using LEDs as light sensors.

Do you get frustrated with your computer system? Do you wonder when "they'll" ever get it right? I certainly do, especially when the computer hangs, I lose work, the Internet connection drops out — need I say more. But perhaps we are being a bit hard on the industry — something you probably thought I'd never say, given my criticisms of the past. But consider this...

I suggest there's a parallel between the evolution of the motor car and the personal computer. They are both very complex, and they are both marketed directly at the public. These days, with training and practice virtually anyone can drive a motor car, anywhere in the world; even those who hate driving and who have no idea how a car works. And that, surely, is where computers are heading.

Clearly it will be some time before personal computer systems (software and hardware) are like today's motor car: reliable, standardised, easy to drive and so on. So how long do we have to wait? Perhaps we can get some idea by looking at the history of the motor car, which very briefly goes like this:

The first practical motor car was invented in 1886 by Benz. Twenty two later, in October 1908, Henry Ford announced his Model T; it sold over the next 19 years, more than 15 million in the US, almost a million more in Canada, and 250,000 in Great Britain. According to *Encyclopaedia Britannica*, this 'remarkable number of cars was made possible by the most advanced production technology yet conceived'.

In 1924, in Rome, the first automobile-orientated road, the autostrada, was opened to the use of fast traffic in the environs of the city. In December 1927, to meet a changing market, in which many cars now had a conventional gearshift, hydraulic brakes, six and eight cylinder engines, Ford introduced the Model A. You probably know the rest, with cars become increasingly reliable, cheaper, safer and just plain better.

The history of the personal computer starts in January 1975, when the US magazine *Popular Electronics* published construction details of the Altair, a small personal computer developed by Ed Roberts. Within a few years, as in the car industry, the personal computer industry was well under way, giving us Microsoft, the Apple II, the Mac, the IBM PC and so on.

In 1908, car owners needed to know how their vehicle worked, how to fix it, service it and what to do when it broke down. Today's computer users need much the same knowledge about their system, or to hire someone to help them when it crashes. Today, only enthusiasts bother about knowing how their car works. For the rest of us, it doesn't matter any more, as cars rarely break down, and when they do there's a well developed support system to help us. But it's taken a long time to reach this stage.

It's now 23 years since the first personal computer. So if I'm right in my analogy, today's PCs are equivalent to a Model T Ford! Furthermore, we probably need another 20 years before things settle down to bring computers to the status of a Model A Ford. And it could take a further 20 years before computer systems have the same reliability, standardisation and ease of use as a modern motor car. It's one thing to make a computer for specialists, but entirely another when it's aimed at the public.

Since arriving at this analogy, I've become more mellow about computer problems. I now realise the industry is working as hard as it can to achieve the same goal the car industry has. It is doing this because it's the only way to make money. The evolution is continuing, but we are still at the early stages yet. I'm most interested in your opinions on this analogy.

In line with the above, we can expect all kinds of new technology that will collectively improve computers. A technology I know very little about is the Firewire interface, a serial data system that seems to be gaining ground. (An analogy to the development of roads and highways perhaps?) The first letter is in response to a reader (Sean McHugh, Fannie Bay NT), who wanted to know more about this interface.

No doubt hundreds of readers have already enlightened you about the Firewire (IEEE1394) interface. You can find out more about it from the Texas Instruments Web site at http://www.ti.com/sc/1394. There's also an interesting article comparing IEEE1394 with USB in Asian Electronics Engineer, *November 1997, page 44. As you'll read it's not a glorified SPI or I²C!* (Daniel Ford, via email)

Daniel also sent me a printout from the TI site, with quite a lot of information about this new interface. Many thanks, Daniel. Incidentally, you are the only reader to 'enlighten me' on this interface, so it seems it's not really general knowledge, at this stage.

After reading Daniel's email, I logged onto the TI site, and it certainly seems as though this is the next generation interface. There's a lot of information about it on the site, so the following is a very condensed extract:

Until now, internal performance advancements have largely fuelled the rapid growth of the personal computer market. Faster processors, more memory and better graphics have helped create an increasingly easy to use, visually appealing PC environment. Despite this, most peripheral connections are made with the interface technologies of older machines and are starting to limit performance and growth for future applications.

The IEEE1394-1995 high-performance serial bus standard promises to radically alter this by giving peripherals, consumer electronics and telecom products a flexible and universal way to transfer data. For consumers, this will redefine the role of their PC from a stand-alone appliance to the hub of a seamless digital home environment populated with rich, interactive multimedia applications. For manufacturers, 1394 will build a bridge between the

consumer and computer markets, creating fully inter-operable computers, computer peripherals, consumer electronics and networking tools.

Butting in, I think you'll agree that the above supports my assertion that the PC will become a part of everyone's life as its uses increase. Now for some technical details of the interface:

The 1394 standard was developed to provide a flexible and inexpensive way to share real-time (isochronous) information among data-intensive applications such as camcorders, VCRs, DVDs, cameras, set-top boxes, stereos, high-definition TVs and high-quality printers. The standard describes a serial bus driven by a simple yet advanced communications protocol, with some important benefits over the many different existing standard and proprietary interfaces it is designed to replace.

It is a transaction-based packet technology for cable or backplane-based environments. The serial bus is organised as if it were memory space interconnected between devices, or as if devices resided in slots on the main backplane. Device addressing is 64 bits wide, partitioned as 10 bits for network IDs, six bits for node IDs and 48 bits for memory addresses. It currently supports transmission rates of 100, 200 and 400Mb/s, with the potential for a transmission rate beyond 8Gb/s.

There's much more, but no doubt we'll be hearing more about this standard, as it seems it's being taken up by quite a few manufacturers. For more information, visit the Web site mentioned above. Now to a more basic topic: LEDs.

Photovoltaic LEDs

When I first read the following letter, I couldn't wait to test the assertion made by the writer: that LEDs develop a voltage when exposed to light.

I'm curious about LEDs generating voltage under light. Using an ordinary LED, not a photo type, I found it produced up to 1.5 volts when lit by a torch. Furthermore, a low grade green LED produces the same voltage as a premium grade red LED.

So my questions are: Is this voltage good enough for a quick and dirty light sensor for triggering, and what stress does bright light impose on a circuit containing LEDs? Also, what sort of current does the LED produce? (Allen Crisell, via email)

Very interesting questions, Allen. I'm possibly the only person in the world who didn't know that a LED produces a voltage when exposed to light, so for me it's rather a discovery. To find out more, I ran a few experiments to see how useful this phenomenon is.

The first thing I found is that the internal resistance of the voltage generating source in the LED is very high, at around 3MΩ. When loaded with a resistance of 10M, a typical LED produces up to 1.5V, as you found Allen. When the load is 1M, this voltage is around 300mV, which is still a useful output voltage. Two LEDs in series increase the output voltage, providing both LEDs are exposed to light.

But perhaps my greatest surprise is the frequency response. To check this, I placed a LED near a fluorescent tube driven by an inverter running at 24kHz. When viewed on a scope, the LED output voltage was a triangular wave (roughly) at 24kHz! This appeared to be nowhere near the maximum bandwidth of the LED, but I couldn't make the inverter frequency any higher.

It also seems the sensitivity is quite good. I found that a typical 3V torch held about three metres from the LED caused an output voltage up to 200mV (10M load). The same torch held close to the LED caused an output of 1V. I haven't had time to research this further, but it seems a LED can indeed be used as a 'quick and dirty' light sensor, Allen.

To use it, you would need a high impedance amplifier, such as a non inverting op-amp or a FET. It's clearly a 'voltage only' (or constant current) device, like most sensors, so it's very unlikely this effect would cause a problem in a circuit, as most LEDs are driven by a low impedance circuit. And on the topic of impedance...

November's What??

Those of you who tried the November '97 What?? question will have probably read in January that the circuit I presented was incorrect. I then presented the question again in January with the correct circuit, along with the explanation that November's circuit would produce a positive output voltage and have an input impedance dependent on the supply voltage. The circuit as it appeared in November is shown in Fig.1.

I encountered the January issue by accident, and believe you are incorrect in saying that the input impedance depends on the supply voltage, unless of course the original circuit had voltage dependent components such as a diode. However I have a nagging suspicion that it did not, as the revised question includes two voltage sources. Or are these included to 'trick us'?

In any case, for the January question, assuming a zero potential across the op-amp inputs, and zero potential with respect to ground at the output, the input impedance at both circuit inputs (A and B) is 1.33R. (Damien Dunlop, via email)

To see who's right in this, Damien, I decided to build the circuit as in Fig.1. Admittedly this brings in 'real' components, but I suggest it's still a reasonable way to see if the input impedance at either or both inputs changes if the supply voltage changes.

So, I hooked up a 771 op-amp, making all resistors 10k. First, my assertion that the output voltage will be positive and virtually equal to the supply voltage is partly true, but I found it could be either a positive or negative value. It turns out that the voltages at the op-amp inputs are very similar, so it's pot luck as to which way the circuit output goes at switch on.

Now, as you know, the input impedance (or in this case, input resistance) to a circuit is the signal input voltage divided by the input current. So to check if the input impedance changes with the supply voltage, I connected a current meter in series with the 2V input and the circuit. I then varied the supply voltage to the op-amp, and sure enough, the current changed.

This happens because the output voltage of the op-amp depends on the value of the supply voltage. The current taken from the inputs (the 1V and 2V batteries) depends on the voltage at the op-amp inputs, which in

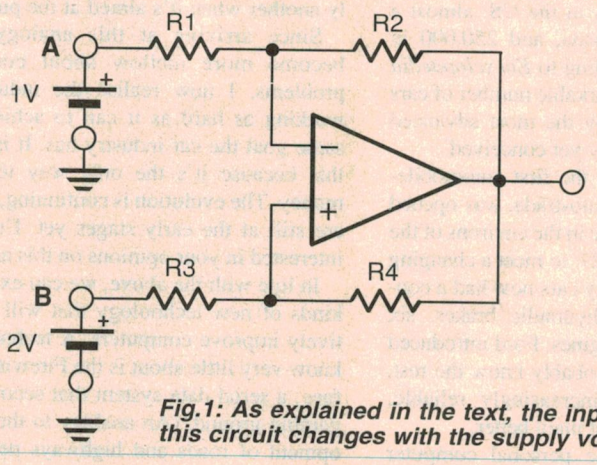


Fig.1: As explained in the text, the input resistance of this circuit changes with the supply voltage.

turn depends on the op-amp output voltage. An unusual case, but an example where a linear circuit has a variable input resistance. Perhaps this question has turned out to be more interesting than we first thought.

Finally, Damien, as you've probably seen by now, your answer to the 'right' circuit is incorrect. The answer and its explanation are in the February edition.

Light guns

Ever wondered how those 'shoot-em-up' guns in arcade games work?

First I want to say what an excellent magazine you have; I spend hours reading it from cover to cover. One thing that has been bothering me as a technician is the toy 'light guns' used to shoot the baddies on arcade games. You can also get these on home game systems, like the Sony Playstation.

I was wondering if you could write an article, or just a small explanation of how these 'light guns' work, as it has been bugging several of us here. (via email)

Unfortunately I don't have our correspondent's name, but thanks for the supportive comments about the magazine. Like you, I don't really know how these guns work. I have lots of theories, but I'll spare you these and instead ask for help from our readers.

LM335 temp sensor

I am interested in temperature monitoring and control circuits (digital or analog) that use the National LM335 precision temperature sensor. This device has a 10mV increase in output per Kelvin rise. I am particularly interested in a circuit like the Universal Temperature controller in the May '97 edition of EA. (Glenn Maughan, Maryborough Qld)

To answer your question Glenn, I looked through an old (1982) National Linear Databook, and a newer Linear Applications Seminar book. There are lots of applications for this device, but we'll confine ourselves to your question about a temperature controller. The circuit in Fig.2 is from the Databook, and as you'd expect, it uses other National devices.

The LM329C is a precision zener reference with a nominal voltage of 6.9V, and the LM395 is a high gain power transistor. You could replace this device with the output circuit of the May '97 controller, which uses a power MOSFET.

TV sets & magnetism

After the following, I think we can say we've dealt pretty thoroughly with the topic of whether there's a difference between the Earth's magnetic field in both hemispheres. As you'll read, there is.

In answer to your question about moving a TV set from one hemisphere to another, I've enclosed an article from the December 1989 IEEE Spectrum, a monthly magazine published in the US. I reprinted it in the Townsville Amateur Radio Club newsletter Backscatter, June 1990. I hope this brings your subject to an informative conclusion. (Iain Morrison, VK4IGM)

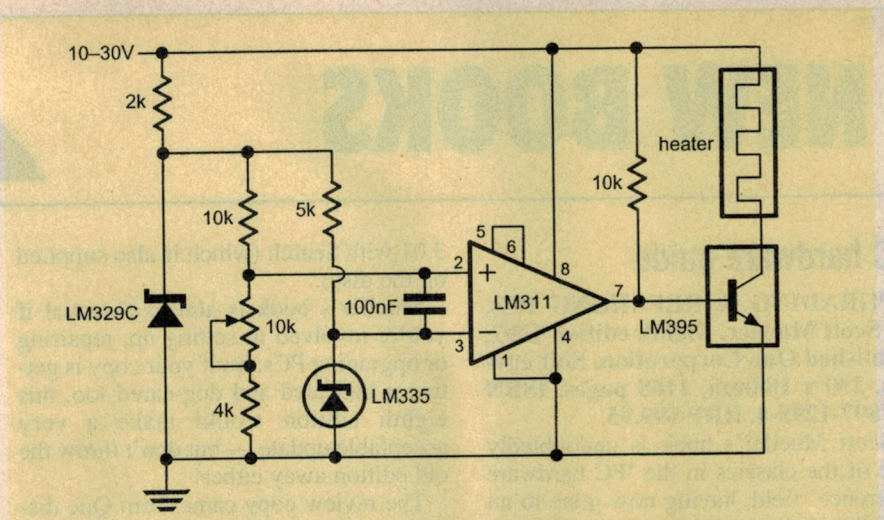


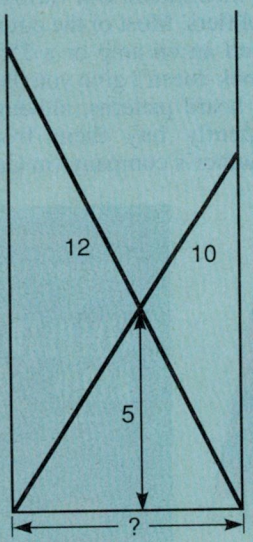
Fig.2: This circuit for a simple temperature controller comes from the 1982 National Linear Databook. The sensor is the LM335.

Many thanks Iain, as the article certainly confirms that there's a problem in moving a TV set from one hemisphere to another. The article is too long to include in its entirety, so I'll pick out the main points. It's headed 'Don't move that CRT' and claims:

The reversal in the Earth's magnetic field from one hemisphere to the other has a small but perceptible effect on a colour video display. NEC, IBM and others sell a different model of their PC colour monitors in each hemisphere. Using the wrong model can mean a shift of two to three millimetres in the centre of the display, and a one or two millimetre tilt from one corner to the other.

The article included an illustration to show why this is so. Unfortunately, being a faxed copy I couldn't make out the differences between the magnetic flux lines on one side of the globe to the other. But, according to the article, NEC adjusts CRTs for Japan, the US and Northern Europe in the ambient field of the factory (facing east during adjustment). For Australian use, the CRTs are adjusted inside a Helmholtz coil.

Fig.3: How far apart are the walls?



What??

A number of readers have told me that although they enjoy questions with an electronic flavour, they also enjoy mathematical questions. As I'm running low on electronic questions (hint, hint! dear readers), I'm presenting a question that is probably a classic of its type. It was sent to me by Dr Roger Cattley, who points out that the question is not as easy as it might look. Roger asks:

Two walls face each other and are some distance apart. Two ladders lean against them from the base of each wall to the wall opposite. They cross at a point five feet off the ground. If the ladders are 10 and 12 feet long, how far apart are the walls?

Answer to March's What

A thick piece of copper wire is all you need. The short circuit caused by the wire means the current taken from a single battery is limited by its internal resistance. When you add another identical battery in series, the voltage doubles but so does the resistance. Therefore the current remains the same! ❖

NEW BOOKS

PC hardware guide

UPGRADING & REPAIRING PCs, by Scott Mueller. Eighth edition 1997, published Que Corporation. Soft covers, 230 x 188mm, 1168 pages. ISBN 0-7897-1295-4. RRP $99.95.

Scott Mueller's book is undoubtedly one of the classics in the 'PC hardware reference' field, having now gone to an eighth edition (and I notice that the review sample was from the eighth edition's *eighth printing*, at that). I have a much-used copy of the third edition in my own library, which I bought in 1994 — and Que were claiming to have sold over 550,000 copies then! I hesitate to think how many it's sold by now...

Strangely enough it's about 200 pages smaller than the third edition, which ran to 1380 pages. It's hard to see exactly what's been dropped, although there seems to be less information on actual *upgrading* of machines. I looked in vain for much specific help on fitting a current-model 2.1GB IDE hard disk into an older 486DX2 PC with a BIOS which wasn't designed to cope with disks larger than 528MB, for example.

Still, there's still an enormous amount of information on PC hardware and system operation, and it's a good deal more up to date than my dog-eared third edition. It also comes with a CD-ROM disc containing electronic, searchable versions of six other Que references — including the fourth and sixth editions of *Upgrading & Repairing PCs* itself, and two others of particular interest and value: *Windows 95 Installation and Configuration Handbook*, and *Windows NT 4.0 Installation and Configuration Handbook*. They all appear to be in PDF format, viewable via Acrobat Reader 3.01 with Search (which is also supplied on the disc).

Mueller's book is almost essential if you're involved in setting up, repairing or upgrading PCs. So if your copy is getting a bit dated and dog-eared too, this eighth edition would make a very acceptable update — but don't throw the old edition away either!

The review copy came from Que distributor Prentice-Hall of Australia, of Unit 4, Level 2, 14 Aquatic Drive, Frenchs Forest 2086. (J.R.)

Learning by doing

BEGINNING ELECTRONICS THROUGH PROJECTS, by A. Singmin. Published by Butterworth Heinemann, 1997. Soft cover, 151 x 235mm, 126 pages. ISBN 0-7506-9898-5. RRP $39.95.

Learning by doing is usually seen as the best way to get to know a subject such as electronics. That's not to say it's also the easiest, as frustration with complex tasks can inhibit the learning process. However if the tasks are simple enough, as they are in this book, then 'getting your hands dirty' is certainly a viable way to get into electronics.

This book claims to teach you the basics through building 10 easy projects. It has some theory to support each project, on a 'need to know' basis. The projects described in the book include two LED flashers, two audio amplifiers and two power amplifiers. There's also an electronic metronome and various types of preamplifiers. Most of the circuits are built around an op amp or a 555 timer IC. The book doesn't give you the printed circuit board patterns, although you can apparently buy them from the author's company (in Canada). However, most of them are simple enough to build on strip board.

The book is organised into 17 chapters, with the first 16 covering the basics of electronic theory. The 10 projects are given in the last chapter, which occupies about two thirds of the book. Being a practical book, the emphasis is on practical issues, such as soldering, the resistor colour code, handling components and so on. It's well illustrated, although not copiously so, and the writing style is easy to read.

The review copy came from Butterworth Heinemann, PO Box 146, Port Melbourne 3207. (P.P.)

Cellular phones

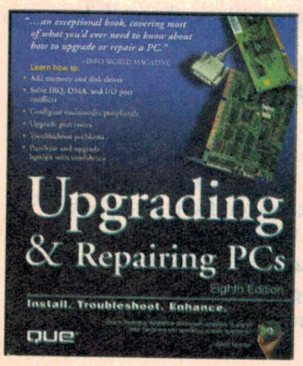
CELLULAR RADIO PRINCIPLES & DESIGN, by Raymond C.V. Macario. Second edition 1997, published by McGraw-Hill. Hard covers, 236 x 158mm, 276 pages. ISBN 0-07-044433-1. RRP $125.

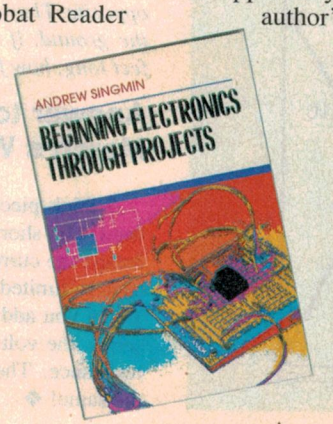
In the last few years cellular radio communications have grown almost explosively in most of the developed countries around the world, and have also become the clear technology of choice for many developing countries as well. This book aims to provide a sound but readable introduction to the technology, for both university and college engineering students as well as engineers and technicians working in the industry itself. It's assumed that the reader has a good basic understanding of electronics engineering; the book is based on lectures given by the author at the University of Wales.

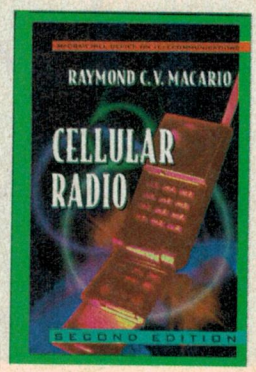
The coverage is quite comprehensive, beginning with the basics of radiotelephony and propagation, and progressing through the concepts of cellular networks through to the specifics of both analog and digital modulation in their various commonly-used forms. The text is generally very clear and concise, and well illustrated. Each chapter also ends with a list of books for suggested further reading, adding to the overall value.

It struck me as being rather more readable and accessible than many of the much larger books I've seen on the same subject — recommended.

The review copy came from McGraw-Hill Book Company Australia, PO Box 239, Roseville 2069. (J.R.) ❖







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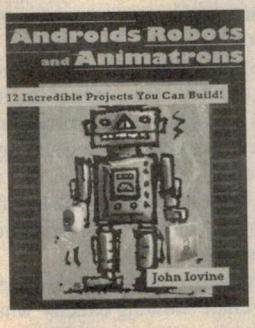

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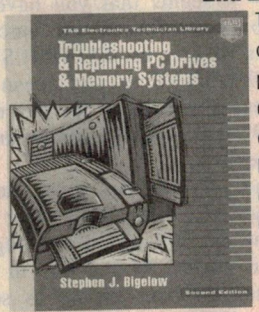

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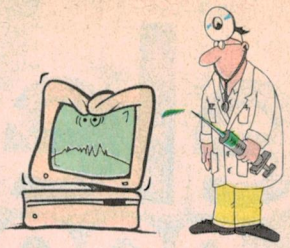


by JEAN-BAPTISTE CATTLEY

Drives, clocks, startup files in Win95 and hi-res text...

I have a bit of a mixed bag for you this month, with questions on Win95 and how to make batch files that aren't, through hard drives that don't seem to add up, and a clock running slow that isn't. Sounds confusing? Well, read on and let's see if we can sort things out...

I want an option!

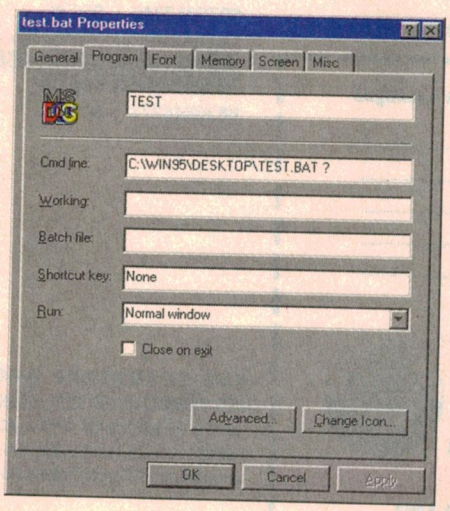
I often want to run a DOS program in Win95 with extra options on the command line. Other than opening up a DOS box and typing the whole thing myself, is there an easy way to do this? (J. Cochrane, Sydney NSW)

Indeed there is. For example, to make a program always run with the '/FOO' switch:

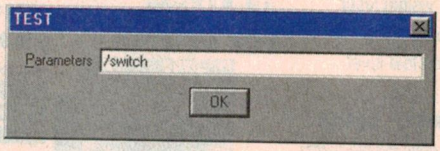
1. Right-drag the program onto the desktop (or anywhere else convenient)
2. Select 'Create shortcut here'
3. Right-click the shortcut, and click 'Properties'
4. Select the 'Program' tab
5. Append your options onto the text in the 'Cmd Line' edit box (eg. **C:\THISDIR\THISPROG.EXE/FOO**)
6. Click OK

This is also very handy for one-line operations that don't justify having a whole batch file to themselves. For example, try creating a shortcut to **COMMAND.COM /C DIR C:\ >PRN.**

If you want to specify different command line options every time you run the program: Perform steps 1-4 (above), and then append ' ?' onto the text in the 'Cmd Line' edit box. (ie. **C:\THISDIR\THISPROG.EXE** ?) See below.
Click OK.



Now when you double-click the shortcut, a dialog box will appear asking you to enter the command line parameters:



Type them in (eg. /B) and click OK, and the program will be run with those options.

Where to start?

If Windows 95 doesn't use CONFIG.SYS and AUTOEXEC.BAT, how can I automatically run programs at startup? (H. Franklin, Sanctuary Point, NSW)

Ah — it seems that you have fallen prey to a common misconception. Windows 95 *does* use CONFIG.SYS and AUTOEXEC.BAT; it just doesn't *need* to. If these files exist on the root directory, Win95 will process them before loading in the GUI.

Whether or not they exist, however, Win95 will also load all the other drivers that it needs, without their being mentioned anywhere. To see this in action, next time you boot hit F8 as soon as 'Starting Windows 95' appears, then select 'Step by step confirmation' from the boot menu. This will ask you to confirm each item in your startup files, as well as the drivers Win95 loads automatically. (Best hit 'Y' to each prompt, or Win95 might not start up properly...)

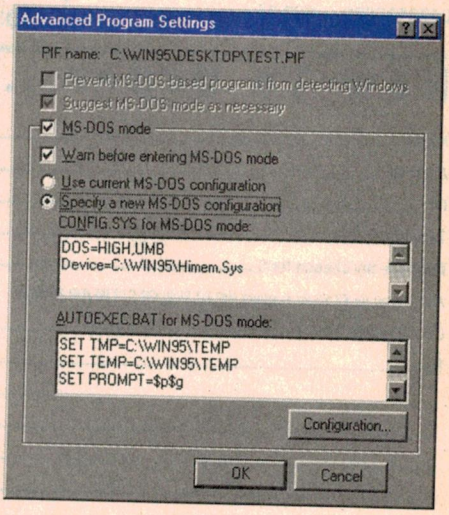
Things really start to get complicated, however, when you start dealing with MS-DOS mode. Much confusion is engendered by the rather slap-happy way in which Win95 deals with startup files for different configurations. To see what I mean, right-click an MS-DOS program and hit 'Properties'. Go to the 'Program' tab, and press the 'Advanced' button. Another dialog box will pop up, as shown at right. Here you can control whether the program will run in a DOS box or in MS-DOS mode, and if in MS-DOS mode, whether to use the default startup configuration, or to use one that you specify in the edit boxes.

If the 'Specify a new configuration' radio button is enabled, the settings in the edit boxes will be used to run the program, completely overriding any existing settings. You will, however have to suffer the system rebooting both before as well as after the program runs, but that's the price you pay for progress...

The process is quite complicated, so I've done up a chart showing exactly what happens with each setting — see Fig.1.

Note that the same-configuration option runs **DOSSTART.BAT**. This is a very handy place to run **MSCDEX.EXE**, in order to get your CD working in DOS. Of course, you'd still need to load the CD drivers in your **CONFIG.SYS**, wouldn't you? So you might think, but that ain't necessarily so.

There have been a couple of programs written over the years that allow you to load in **CONFIG.SYS** drivers *after* bootup. The only one I could find at short notice was **CTLOAD.EXE**, available from Creative Labs' web site, **http://www.creaf.com**. With the aid of this program, or one like it, you can load in the drivers only when you need them, and not have to run them at startup, taking up unnecessary time and resources. Is that handy, or what?



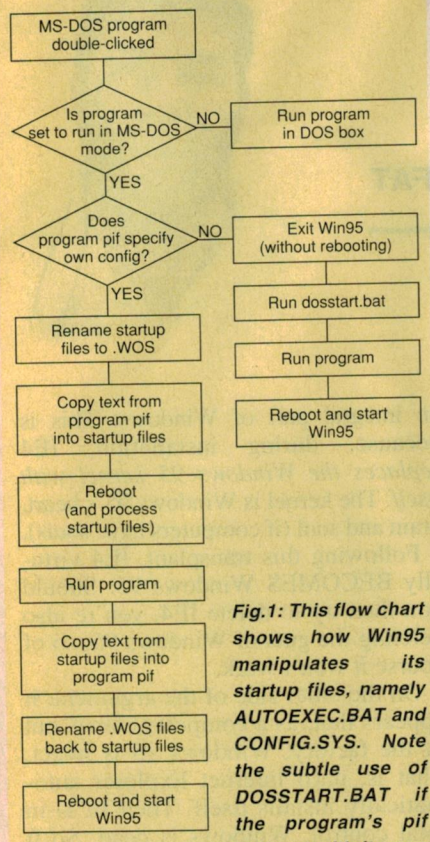


Fig.1: This flow chart shows how Win95 manipulates its startup files, namely AUTOEXEC.BAT and CONFIG.SYS. Note the subtle use of DOSSTART.BAT if the program's pif isn't set with its own configuration.

Battery problems

The clock on my 486DX2 is running slow — only by a few minutes a day, but over a week this builds up to a significant time difference. Is there any easy way to adjust the computer's clock speed to fix the problem? (T. Rietjens, Ballarat Vic.)

In a word, no. I don't think the problem you are having has anything to do with the motherboard/CPU clock speed, but rather with the motherboard's CMOS backup battery. This battery is used to maintain the contents of the system's CMOS settings in RAM while the computer is turned off, and it is also used to run the Real Time Clock which keeps track of the time and date. In my experience it's the first to show signs of suffering as the battery starts to go flat, and the most common symptom is just as you observed — the clock running slow.

So how to fix it? Before you do anything else, note down all your CMOS settings. All your settings will most likely be lost when you replace the battery, and it's very annoying to have to start again from scratch. Before you get out your pencil and paper though, try using PrintScreen on each page of your CMOS settings menu. This has worked on most systems I've tried it on, and can save you an awful lot of time.

The next thing to do is to look for a battery on the motherboard. If it's a small lithium button cell in a holder, then a simple replacement will do the trick. If, as I suspect is the case with your system, you find a small multi-cell (usually blue) battery pack soldered onto the motherboard, then you will need to wire up an 'external' battery.

You should see a small four-pin header located nearby, which is the external battery connector. To install a new battery you'll need to buy a special-purpose replacement lithium cell (about $12), and plug it into the header.

If you don't want to pay $12, and you're vaguely competent with a soldering iron, you can cheat and save yourself a packet. Find yourself four AA batteries, a four-cell battery holder, and a four-pin SIL header socket. Wire the positive lead of the battery holder up to pin 4 of the socket, and the negative lead to pin 1. Put the batteries into the holder and plug in the header, checking that you have it the right way round. If in doubt, use a multimeter to check that what you think is the ground side is actually connected to the chassis (Fig.2).

Whatever replacement option you opted for, there's one very important thing left to do: take a pair of side cutters and carefully clip off the old battery. I've seen too many motherboards thrown away after the old battery ruptured and leaked corrosive fluids all over them. With any luck, your system should be going full speed ahead once more.

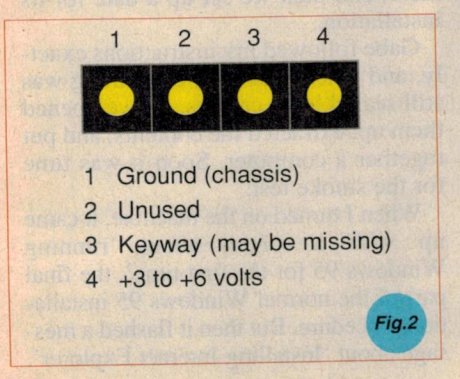


Fig.2

DOS box

Are you sick of the awful screen mode DOS uses? 80x25 may be OK for basic housekeeping stuff, but when you start into more serious tasks such as programming or writing a monthly column, you really need a bigger screen. Luckily, there is a way. If you have a VGA card, (and who doesn't these days?) you can switch to 80x50 text mode, and fit twice as much on your screen. To get into hi-res mode you can either use ANSI.SYS, or, if you are using Win95, you can change the default screen mode setting for the program you want to run.

To go into hi-res mode using ANSI.SYS, edit CONFIG.SYS, and add the line DEVICE=ANSI.SYS. Then reboot.

When you want to use hi-res mode, type MODE CON: LINES=50. (Or if you prefer, include this line in AUTOEXEC.BAT)

When you want to return to normal mode, type MODE CON: LINES=25

If you are using Win95, right-click the program you want to run in 80x25 mode, (such as the MS-DOS Prompt shortcut in the C:\WINDOWS\START MENU\PROGRAMS directory) go to the Screen page, and you'll find a drop-down list marked 'Initial size'. Set this to 50 lines, and you're away.

If this still isn't good enough for you, download HIRES.ZIP from the Electronics Australia BBS, which contains a couple of programs I cobbled together for this column: HIRES.COM and LORES.COM. No prizes for guessing what they do.

Note that not all programs can take advantage of the increased screen size, and some might not even work at all. I haven't had any real problems with this, though, and the benefits easily outweigh any minor niggles you might experience. (Hey, you can always switch back to 25 lines if you really need to!)

If you are lucky enough to have a 17" or larger screen, you'll find that the hi-res text will be much the same size as normal text on a 14" monitor — so give it a go.

The shrinking drive...

I just bought a 1.2 gig drive, and the BIOS reported 1226MB, but according to DOS the drive only has 1,218,753,088 bytes available. Where did the rest of the space go? Should I get my money back? (D. Karznia, Woodville Park, SA)

Don't worry, this is perfectly normal, you haven't been ripped off. It all comes down to a matter of semantics. The two gigabytes specified on the label refers to the drive's unformatted capacity. When you format a drive, the drive is divided into sectors to allow the system to store data on any specific part of the disk. All of these divisions take up space, however, and can consume up to 20% of the drive's capacity!

The reason they don't sell drives by formatted capacity is that different operating systems format drives differently, taking up different amounts of space, so they just specify the unformatted size and let *YOU* work it out. Another great confusion arises from the fact that in the hard drive market there is no standard as to whether MB stands for MegaByte or Million Bytes. As a megabyte is 1,048,576 (1024 times 1024) bytes, this can lead to quite a difference over the space of a thousand or two MB. If you buy a drive advertised as holding 1226MB, that could mean an unformatted capacity of 1226*1000000 = 1,226,000,000 bytes, or 1226*1,048,576 = 1,279,262,720 bytes — a difference of 53,262,720 bytes! ❖

Got any computer queries? Whatever is bugging you, from hardware problems to C programming, send it in and we'll soon have you fixed up. You can email your question to electaus@magna.com.au, or fax or mail it in to us here at EA.

Moffat's Madhouse...

by TOM MOFFAT

Defusing Internet Exploder

What follows here is a sorry tale of — dare I say it — corporate greed? A furious debate is raging in the USA at the moment, surrounding what seems on the surface to be a technical subject: Should Microsoft be allowed to force computer makers to include the Internet Explorer web browser, as a condition of supplying Windows 95?

The debate has spread far beyond the computer industry, into the world of government and high finance — and most importantly, onto the desktops of our computers. The debate has reached official levels with an action by the US Justice Department, ordering Microsoft not to force Internet Explorer into new computers during the installation of Windows 95.

The debate has polarized into two distinct camps: those behind Microsoft, and those favouring the Justice Department. Many of the people involved are political heavies, yet their alliances don't follow party lines at all.

For instance, the Microsoft corner includes such people as Vin Weber, a close associate of Newt Gingrich, who is in effect America's Leader of the Opposition. Also pulling for Microsoft is Tom Downey, who has close connections with President Clinton; that's the same President Clinton whose Justice Department is hammering Microsoft. In the Justice Department corner is former Democratic press secretary Jody Powell, and former Republican presidential candidate Bob Dole. This is like throwing cats and dogs into the same cage.

The thrust of the argument is this: pro-Microsoft forces say the company should be allowed to design and sell its products any way it cares to. The anti-Microsoft side says the company is forcing unwanted products upon consumers in order to squash the competition and have the Internet industry to itself.

If this is indeed Microsoft's intention, then it seems to be working. Microsoft's major competitor is Netscape Communications. Netscape introduced the first commercial World Wide Web browser, allowing the Internet community to navigate around the web with a click of a mouse instead of typing in Unix commands.

A couple of years ago, Netscape's stock shot from US$14 to $86 in one day on the strength of its browser success. Now it's back down to US$18, and just last week (as I write) Netscape announced the sacking of several hundred employees.

Getting locked out of new computers by Internet Explorer is a certainly a major factor in Netscape's misfortune, but financial experts say a lot of the problem is Netscape's own fault — particularly trying to charge big bucks for its Navigator browser while Internet Explorer is being given away.

All the legal wrangling came to a head just before last Christmas, when Microsoft refused to obey a Justice Department directive to supply Windows without including Internet Explorer. Microsoft claimed that IE was an integral part of Windows 95, and Windows would not function if IE was removed. Thus it was impossible to supply Windows without IE.

The judge handling the case promptly brought in a computer consultant, who spent 20 minutes with a computer in a back room. Then he came back into court and announced he had indeed deleted IE from a computer and Windows worked just fine. I'm not sure what method the consultant used, but stick with us here and I'll tell you of a four-step plan to completely and finally exorcise Internet Explorer. Perhaps we should send a copy of this article to Microsoft, and they can learn how to do it too...

Who's telling the truth here? Both sides, actually. Internet Explorer — at least the current Version 4 — is indeed an integral part of Windows. This is because, during installation, IE4 *replaces the Windows 95 kernel with itself*. The kernel is Windows 95's heart, brain and soul (if computers have souls).

Following this transplant, IE4 virtually BECOMES Windows 95. Should you then try to delete IE4, you're also deleting the guts of Windows 95, so of course it won't work.

On the other side of the argument, it appears that, as a computer comes out of the factory, Windows 95 is intact. That is, until Internet Explorer automatically installs itself. Then IE is in total control, Windows is dead. So it seems logical that if IE didn't automatically install itself, the computer would have a normal Windows 95 installation...

At the very height of this debate, in the weeks leading up to Christmas, I was asked to set up two Dell Dimension computers, from scratch, right out of the box. I had asked both of these clients not to touch or turn on these computers until I was present.

One client was a retired Los Angeles cop named Gabe, a fairly senior cop judging by his waterfront home in Port Townsend, Washington. Gabe had called me in as a consultant when he first decided to buy his computer, and after weighing all the options and uses he planned for it, the choice was Dell. He ordered it by phone while I was there, and then we set up a date for its installation.

Gabe followed my instructions exactly, and when I arrived, everything was still sealed in its cartons. So we opened them up, extracted the contents, and put together a computer. Soon it was time for the smoke test.

When I turned on the machine, it came up with a screen about 'running Windows 95 for the first time', the final part of the normal Windows 95 installation procedure. But then it flashed a message about 'Installing Internet Explorer'.

"Wait! Wait!", I yelled, but the computer took no notice. Soon the machine rebooted and came back looking like an Internet page instead of a desktop.

EVERYTHING looked like an Internet page, and it was interesting to note that there was lots of open space on them. It occurred to me that there was plenty of room for Internet-style advertising in future versions of IE. An ad on every screen — how about that!

Well — what do we do now, I thought. I expected Windows 95 on the Dell, and now we've got this! But it was my lucky day. Gabe liked the look of it, the computer seemed to work all right, and we got the Internet working without incident. So we decided to let Internet Explorer have its way, this time around.

In fact Gabe was so pleased with that computer that he insisted on cracking a bottle of champagne the moment an image came on the screen. This was followed by fine Italian dinner with Gabe and his gracious wife. What a way to earn a living!

The other client was a doctor, who had a network of five computers throughout his surgery. The new Dell was going to be *his* personal computer, and a very fitting machine it was, too. Big, fast, powerful, rugged, and goof-proof. Well, almost.

The doctor couldn't wait. He got his knife, slit open the patient, plugged it all together, powered it up, and proceeded to click his mouse on everything, just to see what would happen.

When I got there the computer wouldn't boot at all, and a complete reinstall from his Windows 95 CD-ROM didn't help things. So it was time for a call to Dell technical support.

The technician who answered was very knowledgeable. When he found that I was a techie too, he gave me some background — especially the part about IE4 overwriting the Windows 95 kernel. He also said there would be difficulty getting the network card to work under IE4.

The four-step plan

Mr Dell-Technician said there was only one thing to do; and thus was born the Moffat's Madhouse Four-Step Plan for Defusing Internet Exploder. This procedure is best performed on a brand-new computer, since it will clobber any user application installations that may be present. However, data should survive, so reinstalling the applications should restore things to normal. Now follow these instructions carefully:

1. Find your computer's emergency boot disk, or it may be called the CD-ROM boot disk. Stick it in the floppy drive and re-boot the computer. It should come up on the MS-DOS 'C:\>' prompt, even if Windows 95/IE4 is broken beyond repair. Before going any further, make sure you can still access your CD-ROM drive; you'll need it later.
2. Under the Program Files directory, you should find a subdirectory with a name such as 'The Microsoft Internet Explorer' or something similar. Look within that directory for a program called IEXPLORE.EXE. If this file is present, you've found your target. Delete the entire directory containing this file, and any subdirectories. The DOS 'DELTREE' command will do this easily.
3. Go back to the C:\> prompt and delete the entire Windows directory using the command DELTREE WINDOWS. This will take several minutes of hard disk crunching; there is a lot of stuff to get rid of.
4. Insert your Windows 95 CD-ROM and run 'SETUP.EXE'. The Win95 installation is somewhat time-consuming, but not difficult. Just follow the instructions on the screen. Soon you will see Windows 95 appear in its normal form, instead of as 'web pages'.

Following this Four-Step plan, the doctor's computer was back to normal, and it was no big deal getting him onto his network again. I installed the downloadable Netscape version 3 as his WWW browser. Then it was time to install Office 97 from its own CD-ROM — but the moment it came up on screen it displayed another icon which wanted to install Internet Explorer again. If they can't get ya one way they'll get ya another...

Internet Explorer Version 3 is almost as tenacious as IE4, although it doesn't go as far as replacing the Windows kernel with itself. The February 1998 issue of *Windows Magazine* carried an article entitled 'Extracting IE', in which it gave detailed instructions about hacking the many IE3 files from all the corners of your computer, including the dreaded registry.

The author of this article had the intention of replacing IE with Netscape Communicator, but there were still enough Microsoft antibodies left behind to launch a major battle against the invader. More hacking eventually succeeded, after an enormous amount of time and energy spent.

Looking at all this guy went through, it seemed to me a simpler solution to removing IE3 would be the Four-Step plan above. Getting rid of the registry entirely, and the Windows SYSTEM directory, are crucial to excising Internet Explorer.

What about the Netscape Navigator option? In its current form, Communicator Version 4, it's an enormous program — bloatware at its finest. But you can choose to download bits and pieces of Communicator if you want to; the Navigator browser on its own, if that's your choice.

This of course assumes Netscape survives. When a company posts an US$89 million loss for the last quarter of 1997, and starts sacking staff, it is very worrying. Netscape is now looking more toward corporate networks and servers. Some people feel Netscape could be taken over by a company such as Sun Microsystems, makers of fine Unix computers. This might save Netscape, but the Navigator browser for home computer users could very well go by the wayside.

So, would this leave Microsoft on its own in the browser market, the final victor? Not quite. There is still that little Opera browser, the Norwegian product which you've heard of before in this column. Opera is now the number three browser in the world, behind Internet Explorer and Netscape Navigator. Should Netscape withdraw from the market, Opera will be number two.

Opera has an interesting product development style. They run a continuous forum on their web site (**opera.nta.no**) in which users can post suggestions of what their ideal browser would be. Sometimes there is also rather vicious criticism of Opera, yet they go ahead and publish it on their own web site. Opera's designers and marketing people (all 11 of them) read this stuff and take it quite seriously, and the results are incorporated into the Opera browser.

Opera's relationship with computer giants is a bit like goosing an elephant. You take a poke and then jump clear to see what happens. Not long after Apple Computer's fortunes unexpectedly improved, the Opera web site carried a splash story claiming the jump in the Apple share price was due to Opera's announcement of a Macintosh version of their browser. All tongue in cheek, of course...

If Opera eventually ends up head-to-head with Microsoft, it will be interesting to see what happens. It's kind of like a band of guerrillas against a major army. Stealth and cleverness, against brute force. We shall see. ❖

50 and 25 years ago...

'Electronics Australia' is one of the longest running technical publications in the world. We started as 'Wireless Weekly' in August 1922 and became 'Radio and Hobbies in Australia' in April 1939. The title was changed to 'Radio, Television and Hobbies' in February 1955 and finally, to 'Electronics Australia' in April 1965. Here we feature some items from past issues.

April 1948

Printed Circuits in Hearing Aids: The subject of much discussion in recent years, the printed circuit technique is making its commercial debut in hearing aids. A complicated collection of components — 173 individual items — in one commercial unit has given way to a printed steatite wafer measuring 1-1/8 by 2-1/4 inches. Three miniature valves are added separately to the wafer and the whole unit, complete with auxiliary components is mounted in a case measuring 4-1/8 x 2-3/8 x 7/8 inches.

Many of the components are manufactured as the sprayed wiring process is followed. Silver ink is first brushed over a stencil covering the plate, the silver being consolidated and bonded to the steatite by heat treatment. A graphite paint is then applied through a second stencil to form the resistors, and these too are heat treated. A third step is to add small discs which act as condensers.

Taxi Call System Popular: Recent reports from the US indicate that the widest use of civilian transport radio channels is being made by taxicab operators. There are approximately 90,000 taxicabs in service, of which no less than 75,000 are destined to be equipped with two-way radio.

April 1973

Siding Springs Telescope Shipped: The new 48" telescope to be used by Britain's Science Research Council to map the southern sky has been tested and is being shipped to Australia for installation at Siding Springs, NSW.

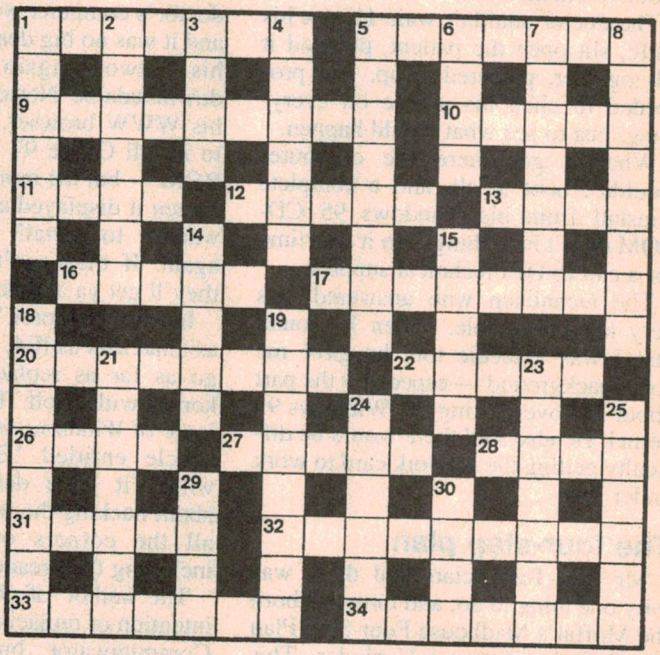
The SRC's atlas will require up to 300,000 photographs to be taken. The most sensitive photographic emulsion known has been developed by Kodak for the work, allowing astronomers to photograph stars down to magnitude 22.

Many new objects are expected to be discovered in the southern sky, such as asteroids, comets and nebulae, just as the northern sky atlas did in 1950.

Doppler Radar on a Chip: At the Mullard Research Laboratories in the UK, distributed thin-film microwave circuit techniques have been applied to an inexpensive Doppler radar module designed to give warning of intruders. The unit replaces the individual microwave elements currently used in microwave intruder alarms.

The system comprises a Gunn oscillator source, a Schottky detector and a circulator which separates the transmitted and received signals and provides local oscillator injection at the detector via the isolation path. All of these elements are incorporated in a thin film circuit on a single 10mm square ferrite substrate, together with appropriate low-pass filtering networks for the DC supply. The Gunn oscillator is varactor tuned and stabilised by coupling to a resonant line. ❖

EA CROSSWORD



ACROSS

1 Type of gas used in certain lamps. (7)
5 Back-up for lighthouse in low visibility. (7)
9 D-to-A device. (9)
10 Said of perfect gases. (5)
11 Computer term for termination. (4)
12 What power of ten is a giga? (5)
13 Increase in magnitude of electrical parameter. (4)
16 Insulated-gate field effect transistor. (5)
17 Drive from its position. (8)
20 Apply excessive strain. (8)
22 Globes. (5)
26 Function of a tape recorder key. (4)
27 Computer language. (5)
28 Untwisted cable format (4)
31 Coach; teacher. (5)
32 Substance that reduces friction. (9)
33 Using multiples of ten. (7)
34 Said of certain liquid crystals. (7)

SOLUTION TO MARCH 1998:

W	I	L	L	I	A	M	O	U	G	H	T	R	E	D
R	I	N	G	■	■	R	E	E	F	■	■	■	■	■
E	F	F	E	C	T	S	■	A	D	A	P	T	E	D
C	T	H	O	N	■	D	H	I	■	■	■	■	■	■
K	N	O	T	■	A	L	B	U	M	■	Z	I	N	C
S	■	F	T	■	D	S	■	M	■	N	■	A	■	■
■	E	F	F	U	S	E	S	■	S	O	C	K	E	T
M	■	■	N	■	R	O	M	■	D	■	■	■	■	E
A	L	F	R	E	D	■	S	E	L	E	C	T	S	■
N	■	O	■	R	T	■	D	■	M	■	R	■	M	■
T	E	R	A	■	A	U	D	I	O	■	S	A	V	E
I	■	M	O	■	R	U	■	L	■	N	■	N	■	■
S	H	U	T	T	E	R	■	M	O	O	N	S	E	T
S	■	L	■	T	E	■	■	N	■	I	■	A	■	■
A	N	A	L	O	G	T	O	D	I	G	I	T	A	L

DOWN

1 Person illegally accessing computer. (6)
2 Hazardous period in air navigation. (7)
3 Neither B or W. (4)
4 Powerful acid. (6)
5 Immediate help for a shock victim. (5,3)
6 Network for electricity distribution. (4)
7 Quantity on which maths procedure is done. (7)
8 Not more extensive. (2,6)
14 TV set (colloquial). (5)
15 What is formed in a Wilson chamber? (5)
18 Calculated. (8)
19 Type of circuit pattern. (8)
21 Capable of returning fully after stress. (7)
23 Used in older fluoro's. (7)
24 Kind of cable. (6)
25 Said of non-dynamic form of electricity. (6)
29 Unit of mass. (4)
30 Thin layer. (4) ❖

Electronics Australia's

Professional Electronics

S◆U◆P◆P◆L◆E◆M◆E◆N◆T

US SCIENTISTS FIND FASTEST PULSAR, SPINNING AT NO LESS THAN 60 TIMES/SECOND!

VALE JOHN BEEZLEY, FOUNDER OF BWD ELECTRONICS

A LOOK AT THE ART AND POLITICS OF CRYPTOGRAPHY

IBM RESEARCHERS DEVELOP PROTOTYPE CMOS PROCESSOR CHIPS OPERATING AT 1.1GHZ

THE ZIPSHOT: EASY TO USE UNIT CAPTURES IMAGES IN HIGH RESOLUTION FROM VIDEO, AT UP TO 10 PER MINUTE. TAKES ITS POWER FROM THE PC, IS ALSO TWAIN COMPATIBLE...

NEWS HIGHLIGHTS

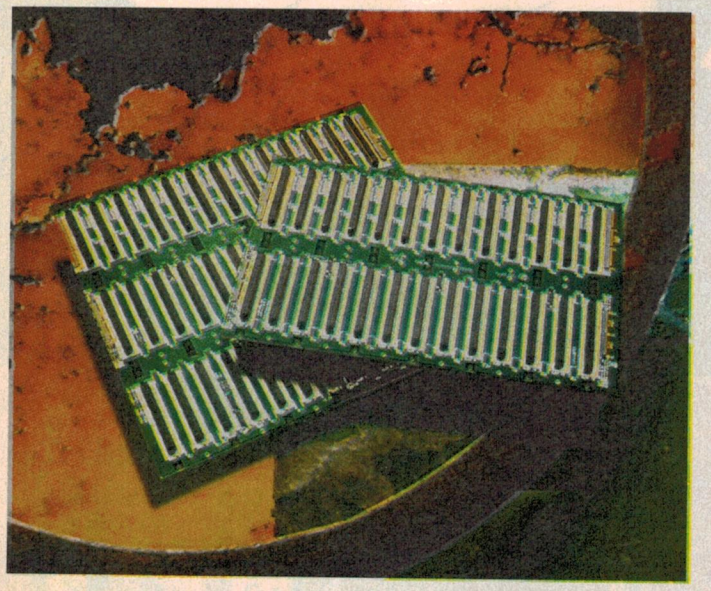
VANTIS UNVEILS NEW 'VARIABLE GRAIN' FPGA

AMD offshoot Vantis has entered the FPGA market with an innovative family of 'Variable-Grain-Architecture' devices, the VFI Series, and powerful new Design Direct software. With 250MHz pipeline performance, the VFI family is claimed to deliver 50-100% faster system speed than any other mainstream FPGA vendor's devices.

Vantis' new architecture employs a 'variable grain block' (VGB) structure, critical for the highest silicon efficiency and performance. The novel architecture provides the ability to vary the FPGA logic block configuration to adapt to a large variety of possible applications and design styles. Each logic region in the VGB is capable of efficiently implementing all possible fine-grained three-input functions to many very coarse-grained 16-input functions, all providing extremely high performance. In addition, two VGBs may be combined through dedicated high-speed logic and interconnect to form 32-bit wide functions. Vantis says the ability of the architecture to vary its width from three to 32 inputs enables the most efficient and high-speed implementation of customer logic possible.

Based on 0.18um process technology, the first VFI product family includes devices up to 36,000 gates (functionally equivalent to 50,000 gates when on-chip memory is included). The Variable-Grain-Architecture is expandable up to 250,000 gates in this process generation.

Vantis' new Design-Direct software is an internally developed implementation that exploits the performance of the new architecture. The software is described as a 'push-button', out-of-the-box design solution that supports standards-based, high level design methodologies such as VHDL and Verilog. Design-Direct software is available on UNIX, Win95 and WinNT operating systems.



C-MAC Interconnect has released a new range of advanced technology backplanes for VMEbus and VXIbus systems. The backplanes use a reliable 12-layer PCB construction.

TOSHIBA DEVELOPS MPEG4 VIDEO CODEC

Toshiba Corporation has developed a prototype single chip low-power video codec LSI that will support future generations of power-sensitive wireless information terminals, including mobile TV phones. The LSI is the first in the world designed to support video signal encoding and decoding in the MPEG4 format, and has built-in software programmability that assures its compatibility with any revisions to the MPEG4 specification.

The new device achieves the high-level processing performance required for MPEG4 while making significant reductions in power consumption. A series of Toshiba-developed low-power technologies cuts power consumption to 60mW at 30MHz operation — an approximately 70% improvement over the same chip without the technologies.

Toshiba's prototype is compatible with the MPEG4 committee draft version 1, and is designed to support the H.263 format. This encoding and decoding TV conferencing format is recommended by the ITU, and its adoption for the MPEG4 format is expected. In the H.263 format, 10 QCIF picture frames (176 x 144 dot) are processed in a second at 30MHz operation.

The prototype LSI was fabricated with 0.3um CMOS technology, and packs three million transistors on a nine-millimetre square chip.

ASSOCIATION FOR VALVE ERA TECHS

The Association of Radio Mechanics Inc has been formed in Western Australia, to provide a forum for people interested in the technical aspects of vintage valve radio sets, and who are in need of information and practical repair workshop training. The Association holds regular meetings and is also inaugurating a quarterly publication containing material culled from other sources, and with details of practical and theoretical contacts in the trade.

More information is available from secretary Mr John Holmes, Unit 2, 10 North Street, Midland 6056; phone (08) 9274 5126.

TERADYNE LINKS WITH WANDEL & GOLTERMANN

Teradyne Inc and Wandel & Goltermann have signed a partnership agreement for developing test solutions for communications products. Wandel & Goltermann will integrate their IMPACT test solutions for communications products into Teradyne's Spectrum 8800 Series VXI manufacturing test platform.

"We're excited to be working with Wandel & Goltermann because of their years of experience with VXI-based open architecture communications testing", said Joe Wrinn, GM of Teradyne's Assembly Test Division in Walnut Creek, California.

Switching Test Solutions AG of Zurich, the former joint venture of Alcatel Schweiz AG and Wandel & Goltermann GmbH of Germany, is now a full member of the Wandel & Goltermann Group. This gives Wandel & Goltermann an R&D and manufacturing presence in Switzerland in addition to its existing divisions in the USA, Germany, France and the UK. The company also has 29 sales companies and 60 representatives in 75 countries.

CYBEC TEAMS WITH ONTRACK

Australian anti-virus specialist Cybec, well known for its Vet package, has signed a distribution agreement with leading US-based data recovery provider Ontrack Data International of Minneapolis. Under the agreement Ontrack and Cybec will provide a combination of software and services designed to protect and care for users' valuable computer data.

Through the agreement, Ontrack has exclusive rights to distribute Vet anti-virus software in North America, Germany and France, and non-exclusive distribution rights throughout most other parts of the world. Ontrack will distribute Vet on-line and through direct sales, and will also bundle the product with Ontrack Data Advisor software. In addition, Cybec will bundle Data Advisor software with Vet throughout the world.

NEW WAFER FAB FOR LUCENT & CHARTERED

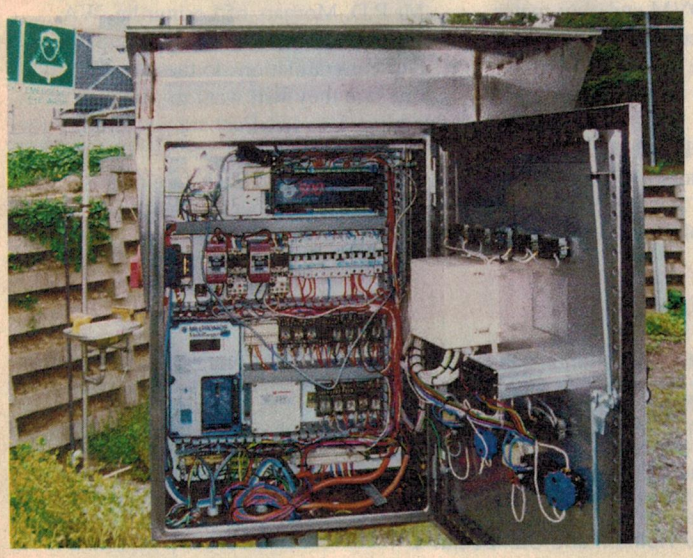
Lucent Technologies' Microelectronics and Chartered Semiconductor Manufacturing have announced the formation of a US$1-billion-plus joint venture to manufacture integrated circuits in Singapore. Called Silicon Manufacturing Partners, the joint venture will eventually employ about 800 people and will manufacture a variety of integrated circuits using process technology developed by Lucent's Bell Laboratories, as well as technologies developed by Chartered.

The alliance will help each company to reduce the capital-intensive investment of building a wafer fabrication facility. Wafers from the fab will be used by Lucent's global customer base in such products as computing equipment, cellular phones, and other electronic devices. Chartered will use its portion of the capacity to support its customers around the world.

The joint venture company will be located on Chartered's semiconductor fabrication campus at the Woodlands Industrial Park in Singapore. Lucent Technologies Microelectronics will own 51% of the joint venture company with Chartered owning 49%. Initially the joint venture company will produce 8" wafers using 0.25um processing technology, but expects to migrate to 0.18um technology by the year 2000.

RAMTRON WINS PATENT FOR ENHANCED DRAMS

Ramtron International Corp. of Colorado Springs has been issued a fundamental patent (No. 5,699,317) by the US Patent and Trademark Office, covering its Enhanced DRAM products. The patent's claims cover the basic architecture and method of operation that allows the EDRAM to achieve industry-leading performance.



The Siemens IC fab plant in Dresden, Germany has been delivering its first samples of 64-megabit SDRAMs, manufactured using a 0.25-micron process. The devices are based on trench cells and operate from 3.3V.

The EDRAM, developed and marketed by Ramtron subsidiary Enhanced Memory Systems Inc is claimed to be the world's fastest dynamic random access memory.

The EDRAM patent brings Ramtron's total portfolio of issued US and international patents to 110, with an additional 97 patent applications filed.

"We have developed a memory solution that, we believe, solves the industry's most pressing memory bottleneck issues", said L. David Sikes, Ramtron's chairman and CEO. "Now that we own the fundamental intellectual property, we plan to form strategic partnerships to advance EDRAM technology in the marketplace."

FASTEST-SPINNING PULSAR DISCOVERED

Scientists have announced the discovery of a superdense star spinning at more than 60 times per second, and calculate it could have been spinning as fast as 150 times per second or more when it formed some 4000 years ago. Most astronomers had not previously believed this class of star, called a pulsar, could form with such a rapid spin.

"This shatters the glass ceiling", said astrophysicist John Middleditch of the US Department of Energy's Los Alamos National Laboratory in New Mexico. "This is the fastest high-energy pulsar of its type we know about."

"The pulsar is spinning twice as fast as any young pulsar that we have seen before", adds Dr Frank Marshall of NASA's Goddard Space Flight Center in Greenbelt MD, who led the team making the discovery. "To put it in perspective, this pulsar is spinning more than six million times as rapidly as the Earth."

The pulsar was found by Dr Marshall and his colleagues Drs. William Zhang and Eric Gotthelf of Goddard, and Middleditch, by examining X-ray emissions recorded by NASA's Rossi X-ray Timing Explorer spacecraft in 1996, and confirmed with observations using the joint Japanese/US Advanced Satellite for Cosmology and Astrophysics (ASCA) spacecraft.

Pulsars get their name because their emissions appear to turn on and off, or pulse, very rapidly. Astronomers believe the stars channel some of their energy into a beam of radiation, and as the star spins the beam sweeps through space like a lighthouse beacon. By counting how

A large Melbourne firm needs to pre-treat effluent it discharges into the sewer system, and is using a Data Electronics DT500 data logger for the continuous monitoring and control of pH correction needed to meet environmental regulations.

VALE JOHN BEESLEY, BWD FOUNDER

John Beesley, the founder of BWD Electronics and pioneer of Australian oscilloscope manufacture, passed away unexpectedly but peacefully on 11 November, aged 72. He is survived by his wife Helen, son Merrick and daughters Shauna and Rachael.

John Beesley was born in Oxford in 1924, where he attended Southfield Grammar and afterwards worked as a draftsman at Morris Motors. The most influential experience of his younger days was towards the end of the War, when he enlisted in the Navy, and as a Petty Officer went on a tour of Duty to Australia. Whilst in the services, he was trained at the Royal Technical College in Glasgow.

In 1950 he emigrated to Australia and began working for Kodak. Progressing from his work in the Navy as a radar specialist, he began to design and build oscilloscopes and electronic test equipment in the back bedroom of the house he had built during the weekends.

This was the beginnings of BWD — named after Beesley, Wingett and Dewey. (A remark which was sometimes heard was that BWD stood for Beesley, Wife and Daughter. This is not so. Wingett and Dewey's interests were bought out after a time by Bruce Owen.) Later the company moved to the back of a shop in Auburn, then to a factory in Hawthorn, then to Gardner (which is now in the path of the South Eastern Freeway) and finally to Mulgrave. The company produced a full range of oscilloscopes, signal generators and power supplies for educational, trade, service and hobby use.

His finest achievement was the four-channel 880 Powerscope, used for making measurements in AC power circuitry. John had a knack of spotting a need for a product. When he saw an unearthed, Tektronix oscilloscope propped on a cardboard box and being operated by a broom handle, the concept of the Powerscope was born. This instrument, which has the unique capabilty of being able to safely make measurements on three phase power circuits is still manufactured today and is marketed in Europe with the Siemens badge.

He was awarded a patent for this in 1980, and a Prince Phillip design award in 1981.

Another of John's achievements was the Minilab which many of us were brought up on. Its handy collection of power supplies, amplifiers, oscillator etc were just what was needed for educational and research purposes. Designed in collaboration with the Telecom school in 1970, this instrument is also still being manufactured today.

He was a Pioneer of the Australian industry, producing the electrical, mechanical and production designs, filing patents on his designs, writing the handbooks and solving problems. From its humble beginnings BWD provided employment for hundreds of people, and produced over 100,000 pieces of electronic equipment for local and export markets, a major achievement. BWD's descendant McVan Industries still manufactures and exports test equipment.

In his retirement, John approached the Bionic Ear institute. Having heard of the difficulties facing patients in trying to understand speech in background noise, John had invented a directional microphone. As it turned out this form of microphone was already in use, but his inventiveness and keen interest to work on such problems was evident.

John started work as a volunteer, on the use of FM microphones in classrooms. The problems of interfacing these with the cochlear implant (bionic ear) are very substantial and complex. John made great progress in connecting a large number of different FM systems to the bionic ear, and also designed two purpose-built units to cope with the specific EMI problems. Whilst doing this John also maintained a keen interest in other aspects of the Bionic Ear and invented and patented an elegant magnetic connector.

It was absurd that so useful a person should be working for no pay and in due course John was put on the payroll. He worked three days a week for Cochlear Ltd, the manufacturer of the bionic ear, and made a contribution to the welfare of many of the 15,000 recipients of cochlear implants. He worked with patients on a day to day basis and developed a wonderful relationship with them.

John was a delight to work with. He could work at any level, doing anything from mundane repairs to tackling the apparently impossible, often with success. It was his sheer persistence and experience in so many facets of engineering which enabled him to come up with a solution to a problem which most others would have put in the too-hard basket.

Above all, John Beesley was a real gentleman. His death marks the passing of a truly civil engineer.

(Thanks to Merrick Beesley, Peter Seligman and Robert McPherson for this information.)

rapidly the beam flashes at Earth, scientists can calculate a pulsar's rate of spin. When a star explodes as a supernova it leaves behind a lingering core about 15 miles across but packed with as much matter as in Earth's Sun. The star is so dense that neutrons are the only form of matter that exist in the star, thus earning the name 'neutron star'. Those whose rapid spin can be observed are called *pulsars*.

LUCKY WINNERS OF HP LOGICDARTS

In the November 1997 - January 1998 issues of *Electronics Australia*, our parent company FPC Magazines ran a subscriptions promotion in which all new or renewing subscribers to the magazine went into a draw, to win one of seven superb Hewlett-Packard LogicDarts. Each LogicDart is an advanced logic probe which not only performs basic logic monitoring, but also functions as a 3-1/2 digit DVM and ohm meter, a 33MHz frequency counter and a three-channel 100MS/s logic timing analyser.

Here are the names of the seven lucky LogicDart winners:

Mr I. Booth, of Bracken Ridge, Qld.
Mr H. Breuker, of Salisbury East, SA.
Mr B. Champion, of Battery Point, Tas.
Mr J.B. Kirkwood, of Castlecrag, NSW.
Mr T.J. Macha, of Mt Stuart, Tas.
Mr P.D. Morgan, of Lesmurdie, WA.
Mr D. Pulford, of Forestville, NSW.

Our congratulations to these readers, and we're sure they will want to join with us in thanking Hewlett-Packard Australia, for making these state of the art instruments available as prizes. Each LogicDart is valued at $1,130, so that the total value of the seven prizes was $7,910. ❖

NEWS BRIEFS

- **ATUG'98**, the largest telecommunications event/conference in Australia and the Asia Pacific, will run from Monday May 4 to Friday May 7, at the Melbourne Convention and Exhibition Centre. This is the 15th year that the conference has been held.
- Mike Goh has been promoted by **Advanced Micro Devices** (AMD) to the position of director of sales for SE Asia. He will be responsible for overseeing all sales and marketing activities in the SE Asia region, including Australia and New Zealand.
- Digital audio editing and mixing specialists **Fairlight ESP** has appointed Emilijo Mihatov to the position of export sales engineer, responsible for sales to India, Malaysia, Thailand, Singapore, Vietnam and Cambodia. ❖

CRYPTOGRAPHY: THE ART & POLITICS - 1

Not that many years ago, most of us would have associated the topic of cryptography with spy novels rather than a magazine like *EA*. Not any more. While this technology is still crucial for national defence and protection of sensitive government information, it is equally important today for many ordinary people. Most of us are already unknowing users of computer ciphers...

by DR GLENN PURE

Every time you perform an EFTPOS or credit card transaction via a handheld terminal in a shop, or use an ATM at your bank, you are using powerful electronic encryption systems. Anyone who has done any internet banking has used strong encryption software on their very own computer.

Most computer networks also use encryption systems. For example, users are usually required to enter passwords before they can access the network resources. More often than not, these passwords are protected by encryption before being transmitted across the network during log in. Passwords themselves are even stored in encrypted form on file servers, for added protection from hackers.

Very strong encryption is now practical, with the impressive processing power of today's microprocessors. But these ciphers have to be good, because the 'bad guys' can use that same computing power to mount very sophisticated attacks.

Why, then, would many governments around the world be looking at imposing significant restrictions on the use of cryptography? You might be surprised to know that these countries include the US and UK. The Australian government may well be thinking about this too, but it's kept quiet on this so far.

In fact, the wide availability of strong encryption is developing as a major civil rights and political issue. In the past, you or I had to rely on our government to respect the privacy of our phone conversations, e-mails or other telecommunications. Law enforcers and courts retained the ability to eavesdrop on our communications when they thought it was necessary. Encryption has changed the game, by making it impossible for these officials to make any sense of the material they intercept. The ready availability of this technology has enabled ordinary people to control their own privacy, at least for the moment.

Most governments are pretty unhappy about the sudden shift in power and responsibility. They argue, quite rightly, that cryptography can be abused by criminals and terrorists to protect them from the law. But like the examples already mentioned, there are many legitimate reasons why law-abiding people or businesses would need to use strong encryption.

In fact, the growing interconnectivity of today's computer networks, combined with our growing dependence on computer data, is increasing rather than diminishing demand for security tools like encryption. A little later I'll delve into the fascinating crypto debate and some of the 'strange but true' things that have happened. My first task, however, is to explain something about the technical side of cryptography.

There are a number of different types of cryptography. The simplest one is called *secret key* cryptography and has been around for thousands of years. The letter substitution found in a simple newspaper cryptogram is an example of this type of cipher. In secret key cryptography, the same key is used for encryption and decryption — meaning that both the sender and received must share the key.

Public key cryptography is the second major type. With public key, each user has two keys, one of which is used for encryption and one for decryption. This means the key pair owner can (and must) keep one of the keys completely private. This provides public key systems with unique and very powerful capabilities, as I'll explain soon.

There is also a third type called 'one-way' cryptography, or hash functions, which only encrypt and which don't involve keys. Hashes have special and very valuable uses as well.

All of these ciphers are surprisingly straightforward in operation. They use ordinary mathematics and logical operations to combine an input message, known as the cleartext or plaintext, with a key to produce ciphertext (Fig.1).

In computer cryptography, the key is simply a number, anywhere from 40 bits (five bytes) in size to several thousand or more.

Secret keys

As mentioned, secret key cryptography is the classic type. It's sometimes called *symmetrical* cryptography because the same key is used to encrypt and decrypt a message. The key must therefore be kept secret or it becomes useless, since anyone who has the key can decrypt messages coded with it.

There is virtually no limit to the ways a secret key cipher can be designed, so there are quite a few of them around. One of the first computer-based secret key ciphers was DES (Data Encryption Standard) which was published in 1977 and uses a 56-bit key. DES is an openly published standard and is widely available around the world.

DES takes a 64-bit chunk of plaintext and garbles it into 64 bits of ciphertext. Since it processes blocks of plaintext of defined length, it is called a *block cipher*.

Fig.2 shows how DES works. It doesn't involve any special mathematics. In fact, DES relies on a few simple operations including bit shuffling, substitution and sim-

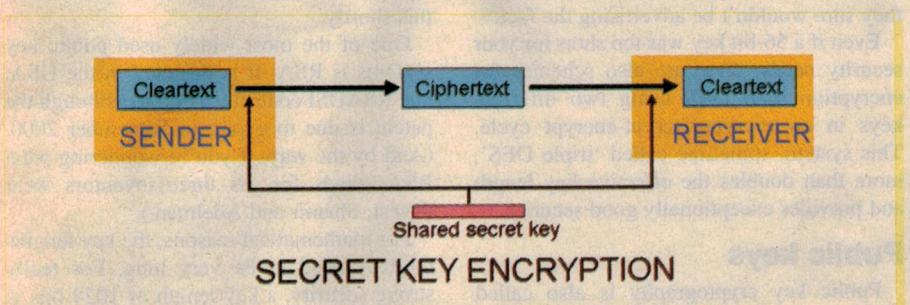


Fig.1: The principle of secret-key encryption and decryption.

ple logical operations.

It is still in wide usage today, for example in the banking industry, and is considered sufficiently strong that the US government, until very recently, had a blanket ban on export of products which used it.

The fact that a cipher almost 20 years old is still considered useful illustrates an important point in cryptography. Like good wine, ciphers normally improve with age. The reason is simple: if, after such a long time, no-one has been able to work out a easy way to break a cipher, then it must be good.

The need to expose ciphers to wide public use — and abuse — before there can be confidence in them also means that do-it-yourself ciphers generally aren't trusted. There might be some obscure attack or backdoor that the designer has missed, or even deliberately put in place.

Nevertheless, there are some incredibly simple secret key ciphers which anyone can implement and use. One of these, called the 'one time pad' is so simple, it uses just a single logical operation available on most microprocessors: the exclusive-OR (XOR) operation. All that is involved is to XOR the plaintext, bit by bit, with a 'key' consisting of a random string of bits of the same length as the plaintext. Decryption is easy too and is performed using exactly the same process — by simply XORing the ciphertext with the same key again.

You might be surprised to learn that the one-time pad is, in fact, the most secure cipher known — but only if it's done properly. Doing it properly means, unfortunately, using a fresh key of random bits every time; and the key must be truly random, not generated with a pseudo-random algorithm. These constraints can seriously limit its practical application.

Coming back to DES, if you take a quick look at the detail of how it works, you might ask why it goes through such a complex set of steps. There are two reasons. First an attacker won't get too far by reversing the process before being stopped by a step involving a key (these can't be reversed without the key).

The second reason is to make it relatively inefficient when implemented in software, so anyone who tries guessing keys randomly will take that much longer to test each one. In fact, simple key guessing is about as effective as any other method for breaking DES...

How secure is DES? With the computing power available now, it is considered feasible to crack a message encrypted with a key only 56 bits long. Nevertheless, it wouldn't be a trivial exercise, since there are 2^{54} possible keys, or about 1.8×10^{16}. If each possible key took one microsecond to check, it would take over 500 years to test every possible key.

In reality, a key can be tested in a lot less than a microsecond. In a challenge issued in January 1997 by the US firm RSA Data Security Inc (RSADSI), a 40-bit secret key cipher was broken in about two and half hours by splitting the task among 250 computers running in parallel. The university student who won the challenge picked up $1000 for his efforts. RSADSI also issued a challenge at the same time for a DES-encrypted message. The first person to successfully find the key to this message would get $10,000.

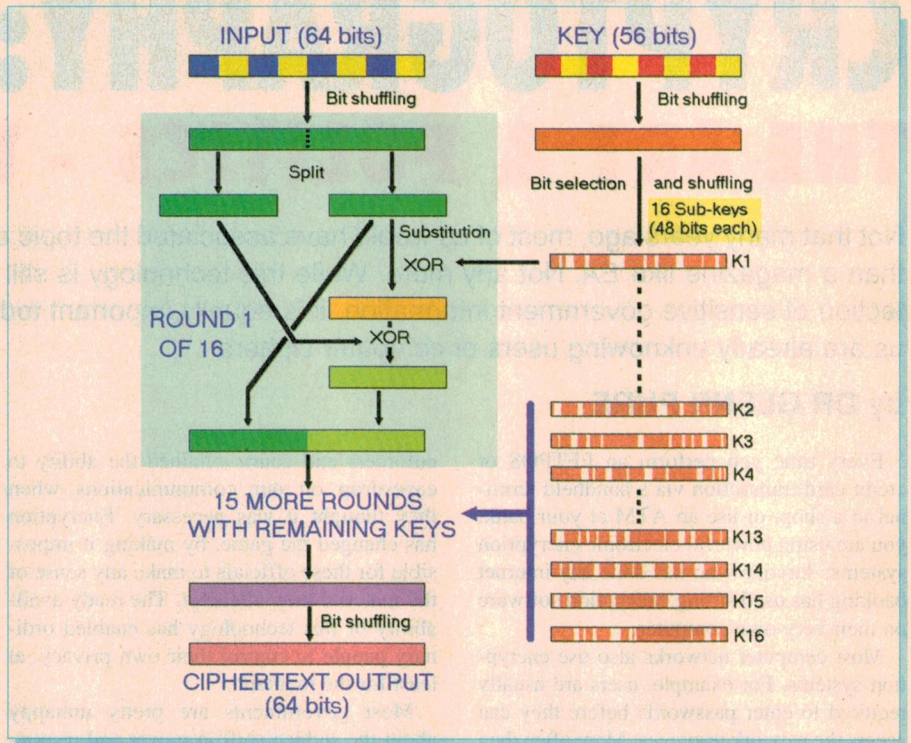


Fig.2: How the DES (Data Encryption Standard) secret-key encryption system works. Developed in 1977, it is still in widespread use.

A 56-bit key is roughly 2^{16} times more difficult to break than a 40-bit key, meaning it would take over 18 years to break with the same computing power used for the 40-bit key.

The DES challenge was won in June 1997, and it took four months to find the key (see box). This was the first documented case of DES being broken — 20 years after it was created. But don't forget, if the 'bad guys' (whoever they might be) could break DES, they sure wouldn't be advertising the fact.

Even if a 56-bit key was too short for your security needs, there are also schemes for encryption with DES using two different keys in an encrypt-decrypt-encrypt cycle. This system, sometime called 'triple DES', more than doubles the effective key length and provides exceptionally good security.

Public keys

Public key cryptography is also called *asymmetric* cryptography, because different keys are used for encryption and decryption. One of the keys is the 'public' key and the other the 'private' key. As their names suggest, the public key can be given to anyone, but the private key must be kept secret.

The basic property of public key cryptosystems is that a message encrypted with the private key can be decrypted with the public key and vice versa. A message encrypted with one key can't be decrypted with the same key. For this to work, the two keys in the pair need to share a special mathematical relationship.

What this means in practice is that anyone can send anyone else an encrypted message, because all the public keys can be made openly available. To send a confidential, encrypted message, you encrypt with the receiver's public key. Only the receiver can decrypt this since only they know the matching private key. (Fig.3)

However the main interest in public key ciphers is user authentication — but more on this shortly.

One of the most widely used public key systems is RSA. It is patented in the USA, and RSADSI controls the rights although the patent is due to expire in September 2000. (And by the way, if you're wondering what RSA stands for, its three inventors were Rivest, Shamir and Adelman.)

For mathematical reasons, the key lengths in RSA need to be very long. For really strong security, a key length of 1024 bits is now recommended. This is a very big number, which would be more than 300 digits

long in our ordinary base-10 numbering system. I chose something slightly more manageable for my own RSA key, which is 768 bits long. Only a year or two ago, most people thought that 512 bits was good enough...

Well, just how secure would a 1024-bit RSA key be? Breaking it would take an estimated 600,000 years on a 100MHz Pentium, using currently known methods for attacking RSA.

RSA is very secure, but this comes at a cost. It takes a lot of processing power to do encryption and decryption. Secret-key ciphers like DES are much more efficient and are definitely the way to go for 'bulk' encryption. Fortunately, there is a way to get the best of both worlds.

Most message encryption systems are actually hybrids, which combine a public key cipher with much faster secret key ciphers. The public key cipher is used to encrypt the key for a secret key cipher, so the latter can be confidentially sent to the other party to a conversation. The secret key is then used by both parties to conduct the private conversation. A fresh secret key (the session key) is usually generated for each new conversation to improve security.

The processing demands of RSA and other public key cryptosystems aren't any problem for a modern desktop computer. Unfortunately, a computer isn't the preferred platform for encryption operations. The problem is that to perform encryption, decryption or signature (the latter is just another type of encryption), the user's key must be exposed.

It's fairly easy to securely store a key on a computer's hard disk, simply by using a password or pass-phrase to encrypt the key itself. However, to use the key, it must be decrypted and loaded into the machine's RAM where it is 'visible'. It is vulnerable here and can be read by software routines that a attacker might manage to covertly load onto your computer — in the same way that a virus might creep into your system.

You might think this is being a bit paranoid, and you are probably right. But cryptanalysts — the people whose job it is to break ciphers — are paid to be paranoid.

To solve this problem, smart cards are increasingly being favoured since they can both store keys and do encryption 'on board', without ever exposing the key. A number of smart cards are now available with separate dedicated on-board processor, solely to perform public-key encryption operations.

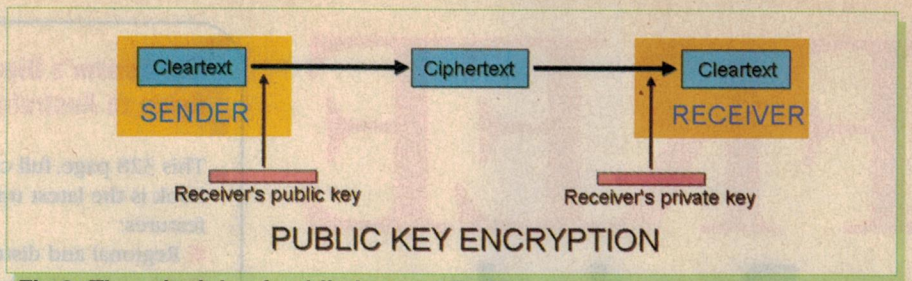


Fig.3: The principle of public-key encryption.

Authentication

User authentication is the real strength of public key ciphers, and a popular way of doing this is with digital signatures. These are functionally similar to ordinary hand-written signatures. They enable you to be sure that a particular person signed and sent a particular message.

A digital signature would usually contain at least the sender's name (or some kind of unique identifier), and a checksum of the message to provide a 'tamper alarm'. If the message is changed, the checksum will no longer match.

To be of any value, all of the information in the signature must be encrypted to prevent others forging it. This is where public key encryption comes in. The signature block is encrypted with the sender's private key. Anyone can check the signature by decrypting it with that person's public key (remember that public keys can be made freely available) — see Fig.4.

Digital signatures are very useful because they can also provide non-repudiation. This means that the party that signed and sent a message can't deny later that they *did* send it. This might be important, for example, for a merchant accepting orders electronically.

Ironclad non-repudiation was virtually impossible before public key ciphers were invented. However, it is easy with a public key cipher. As mentioned, the signature only needs to contain the person's name and a checksum of the message. Since the signature is encrypted with the sender's private key, which no one else is supposed to know, it is difficult for the sender to deny later that they sent a message signed with that key. To abuse the words of Rene Descartes the famous philosopher, 'I encrypt, therefore I am'.

The 'checksums' used in signatures are special. To be of any use, they must be large values, typically around 128 bits, so there is an extremely small probability of any two messages having the same checksum. Special cryptographic functions are used to produce these checksums or 'hashes'. They come under a variety of names including one-way functions, hash functions or message digests. They are effectively irreversible and their sole purpose is to provide a unique 'fingerprint' of a message or file.

The great power of public key systems doesn't, unfortunately, come free of charge. Think about a simple scenario where you wanted to strike up a private conversation with another person using public key encryption. You would first need to obtain that person's public key and they would have to find out yours. In fact, you need to do more than that. You need to be absolutely convinced that the public key you obtain is theirs and not some imposter's, otherwise you will be sharing your secret messages with an imposter.

There are cases where exchanging keys won't pose a problem. For example, where you might know the person and are able to personally be handed their key on a disc. But this will often be the exception.

To get around this, public key cryptography must rely on publicly accessible but secure key stores. The standard approach is to use so-called certifying or certification authorities (CAs), that can testify that a particular key belongs to a particular person.

Worldwide there are only a handful of these in existence at present, and they have only been around for a couple of years. There are several commercial services operating in the US. The first one to start was Verisign, which is a subsidiary of RSADSI.

In Australia, Standards Australia has commenced work on how a CA service might function here, and I understand a least one firm in Sydney provides such a service. Both Telstra and Australia Post have announced they will be offering CA services.

(To be continued.) ❖

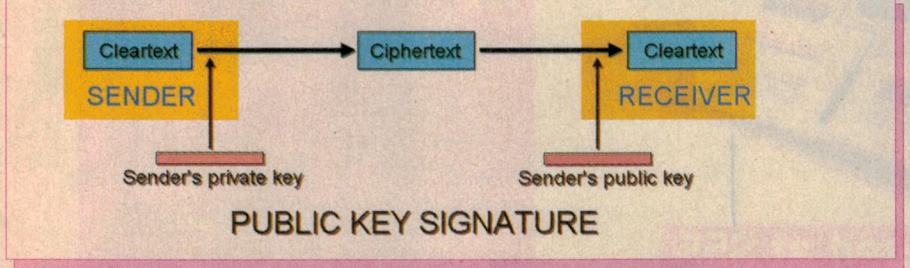


Fig.4: Public key signature authentication.

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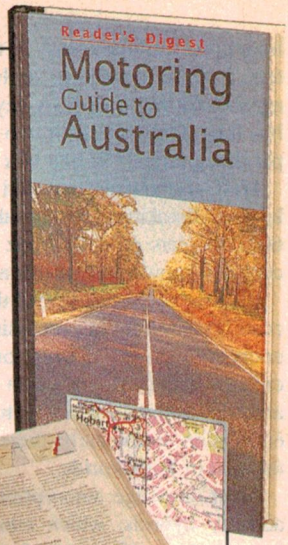

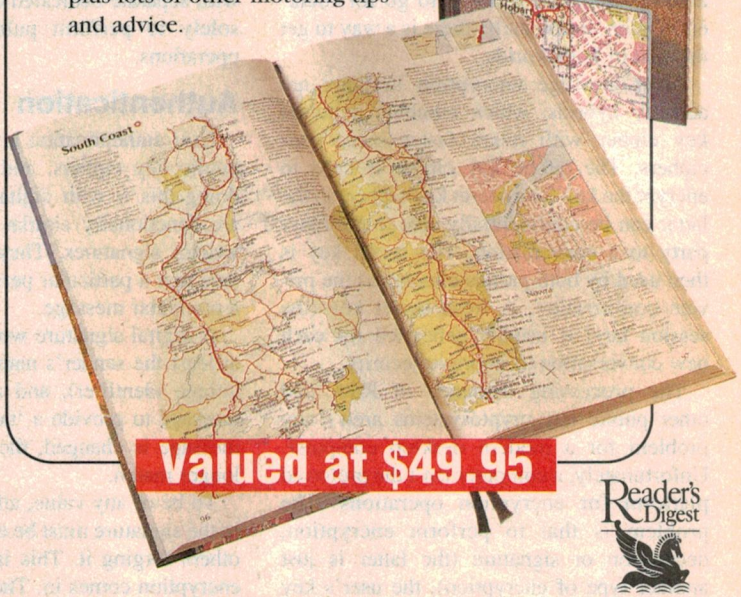

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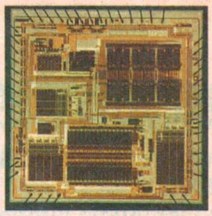


Low cost, low power RGB-to-NTSC/PAL encoder

The Analog Devices AD725 RGB-to-NTSC/PAL encoder achieves new low levels for both power consumption and price. Aimed at personal computer, digital camera and video game applications, the AD725 converts red, green and blue colour component signals into their equivalent NTSC or PAL chrominance, luminance and composite video outputs. The 5V, single supply encoder draws less than 1uA when powered down, making it well-suited for battery-operated portable systems.

In addition to RGB-to-NTSC/PAL conversion, the AD725 also allows for luminance filtering (or Y-Trap) for reducing cross-colour generation produced by subcarrier frequency components in the Y signal. All logic levels are TTL, and the AD725 encoder requires no external filters or delay lines. All three video outputs (chrominance, luminance and composite video) are available separately and at voltages that are twice the standard signal levels necessary for driving 75Ω reverse-terminated cables.

Supplied in a 16-pin small outline IC (SOIC) package, the AD725 operates over a temperature range of -40 to +85°C.

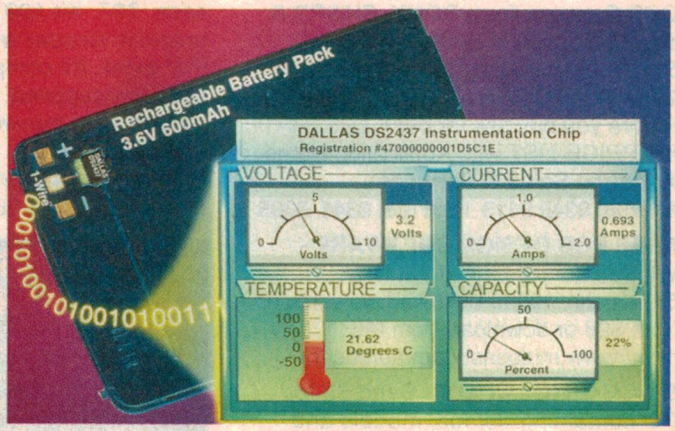
For more information circle **272** on the reader service card or contact Analog Devices, PO Box 2098, Rosebud Plaza 3939.

Single-chip battery manager

Dallas Semiconductor has announced the DS2437 Smart Battery Monitor, claimed as the first device to offer a complete battery data acquisition system integrated onto a single chip. The DS2437 supplies all of the real-time battery data necessary for ensuring that the battery does not overcharge or overdischarge, including temperature, voltage, current, and charge in or out. Further, it supplies memory space to store critical safety and performance information such as battery chemistry, capacity, and manufacturer. The chip fits right into the battery pack, consuming no extra space in the system.

The DS2437 is a single-chip implementation of a Smart Battery, a battery with the ability to educate the host system about itself so that the battery can be charged in an optimal manner. Because of the high level of integration, it is therefore a particularly cost-effective implementation.

For more information circle **271** on the reader service card or contact Dallas Semiconductor, 4401 South Beltwood Parkway, Dallas Texas USA.



Surface-mount optical sensors

Temic Semiconductor has released what it claims as the industry's first fully surface-mountable transmissive optical sensors, for position and motion direction sensing applications. Housed in compact packages with dimensions of only 4 x 5mm and a 4mm height profile, the new devices will save space and simplify assembly in DVD, computer mouse, digital copier, scanner, and camcorder systems.

The single-channel TCPT1200 and dual-channel TCUT1200 are designed with an infrared emitter and a phototransistor detector located face to face on the same optical axes. With a small aperture size of just 0.3mm, the new devices provide a high level of accuracy. The operating wavelength is 950nm.

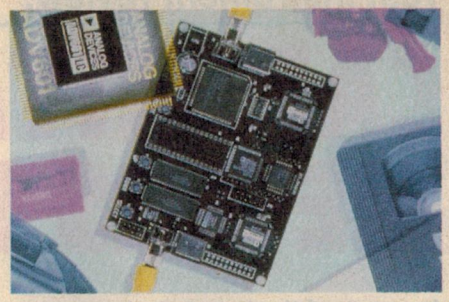
For more information circle **276** on the reader service card or contact distributors Braemac or Avnet VSI Electronics.

Wavelet codec's high video compression

The new ADV601LC video codec from Analog Devices is expected to excite the consumer market for integrated digital video recording, editing and playback. Applications include digital VCRs, TV set-top boxes with instant replay and a wide range of home video editing applications.

The ADV601LC draws on wavelet compression and decompression technology, to operate as both a video encoder which compresses video, and a decoder which expands the video to its original form. The chip attains compression ratios ranging from a visually lossless 4:1, suitable for professional video applications, all the way to an impressive 350:1, suitable for less demanding surveillance applications.

Analog Devices says that the ADV601LC allows PCs to be used for video production in cost-sensitive applications, using a hard disk to store compressed video. The device can compress 25 minutes of VHS-quality video to fit on 1GB of drive space. Other editable compression techniques such as MPEG2 I-frame or Motion JPEG can require up to twice this storage space or transmission bandwidth.



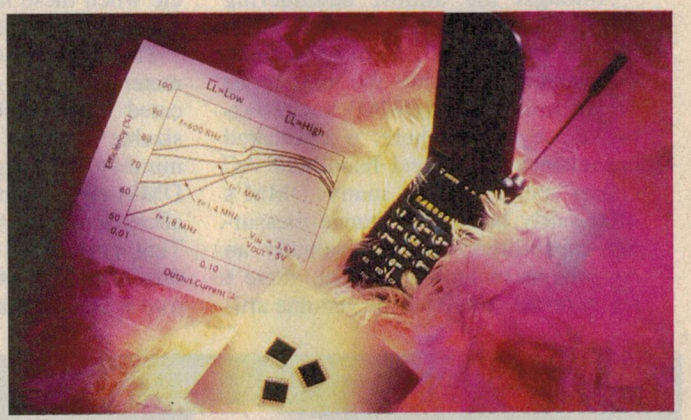
For more information circle **275** on the reader service card or contact Analog Devices, PO Box 2098, Rosebud Plaza 3939.

High frequency converter IC

A high-frequency boost converter IC that will prolong battery life in cellphones has been released by Temic Semiconductor member Siliconix. The new device, which allows designers to take full advantage of the lower power requirements of cell phone standby and receive modes, delivers an average 4% improvement in efficiency compared with any other solution on the market. Its high-frequency operation, up to 2MHz, allows the size of passive components to be reduced, so cell phones using the new chip can be made smaller even while providing longer talk times and standby times.

In addition to reducing design size, the high-frequency operation of the Si9161 solution translates into wider bandwidth, giving designers more headroom when setting the converter to run at a defined frequency. As a result, it's easier to synchronize the converter to keep noise out of sensitive carrier, processing, and intermediate spectrum frequencies.

The new Si9161 provides power to the RF power amplifier and signal processing circuitry, boosting voltages as low as 2.7V up to 3, 3.3, 5, and 6V. It is said to be the first such device to include a light-load pin which optimizes efficiency at loads typical of receive operation. An enable pin can be used to put the converter in a low-current mode that draws less then 330 microamps, minimizing the impact of the converter on battery life when the phone is in standby mode.



For more information circle **277** on the reader service card or contact distributors Braemac or Avnet VSI Electronics.

DSP-based audio filter/equaliser chip

Medianix Semiconductor has introduced the MED25022 Digital Crossover/Parametric Equalizer, a single-chip, multichannel digital filter IC that uses digital signal processing (DSP) to provide parametric equalisation and crossover filtering in a wide range of audio applications, including car audio systems, home entertainment centres, multimedia computers, and audio editing and mixing consoles. This is claimed to be the first time that these functions have been made available in a single application-specific standard product (ASSP).

The CMOS device provides five bands of parametric equalisation with up to 24dB/octave crossover filtering for each of two audio channels. Multiple devices can be used in parallel to provide more channels, or can be cascaded to obtain higher order filters.

All of the desired equaliser band amplitudes and filter cutoff frequencies are programmable. Onchip memory contains the information necessary for the embedded DSP to calculate filter coefficients in real time using the programmed settings. In addition, the on-chip memory provides up to 35ms of programmable digital delay that allows time alignment of audio signals from speakers that are different distances from the listener.

For more information circle **273** on the reader service card or contact Medianix Semiconductor, 100 View Street (Suite 101), Mountain View CA 94041, USA. ❖

Test instrument review:

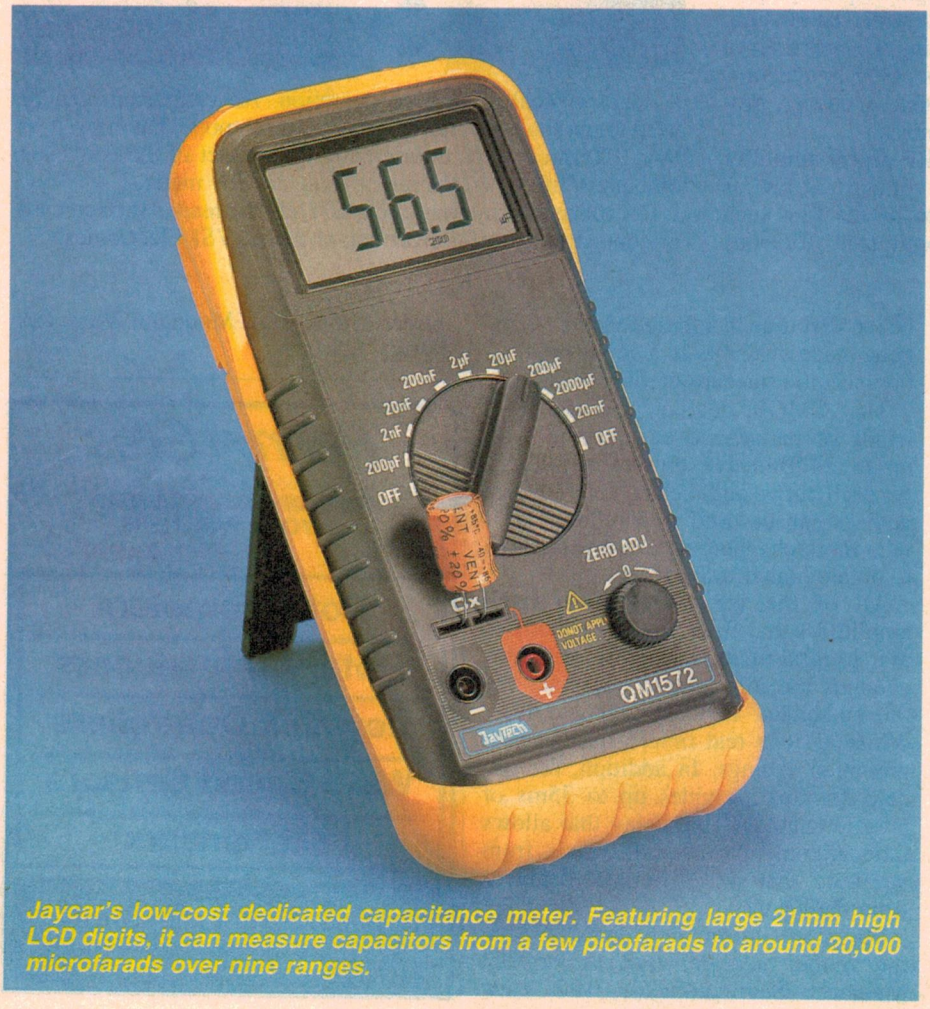
CAPACITANCE, CLAMP METERS FROM JAYCAR

As part of their extensive range of handheld digital meters, Jaycar Electronics are now offering a large-display capacitance meter and a very compact AC clamp meter. Both offer a wide reading range and above-average accuracy, coupled with very attractive pricing.

by ROB EVANS

Amongst the almost bewildering array of handheld digital meters on the market nowadays, the most popular instruments alongside the ubiquitous digital multimeter (DMM) are probably those shown here: a dedicated capacitance meter and hand-held AC clamp meter. While many DMM's offer fairly basic capacitance measuring capabilities, and occasionally an AC clamp meter attachment, there's really no substitute for the genuine article when these measurements must be made in a quick and reliable way.

The Jaytech QM1572 capacitance meter is a good example of this dedicated handheld breed, and features a sizable 3.5-digit LCD display, a large number of ranges, and unlike the DMM equivalent, a zero set control to allow low-capacitance measurements. That's really all there is though, since this is a dedicated instrument in the true sense and makes no concessions to other component value measurements such as inductance or resistance.



Jaycar's low-cost dedicated capacitance meter. Featuring large 21mm high LCD digits, it can measure capacitors from a few picofarads to around 20,000 microfarads over nine ranges.

The first aspect that strikes you about the QM1572 is the LCD readout's large (21mm) digits, which seem to have an unusually a high contrast and viewing angle for a meter in the sub-$100 price bracket. There's certainly no confusion when reading the display from even a considerable distance, and as a novel touch, the range switch setting is also shown on the LCD as a small subscript under the decimal point.

With selectable ranges of 200pF to 20mF (note: millifarads!) in eight x10 steps, the QM1572 offers a theoretical capacitance measuring range of 0.1pF to 19.999mF (that's 19,999uF) with a best quoted accuracy of 0.5%. In both range and accuracy terms this is *much* better than the equivalent capacitance measuring feature offered by DMMs, which should make its $89.50 purchase price easy to justify for many users — particularly if you measure a wide range of capacitors, on a regular basis.

The QM1572 is housed in a typical plastic screw-together case measuring 190 x 90 x 30mm which must be opened for battery replacement. The unit itself then fits into a molded 'safety yellow' soft plastic holder with an integrated tilting bail (plus probe holders) at the rear. Judging by the rather brittle plastic used for the case of most low-cost meters, this shock-resistant 'holster' should be quite an asset in preserving the life of the instrument.

The meter is supplied with two short banana-to-clip test leads for external connections, while small short-legged capacitors can be pushed into the front panel measuring socket. Also, the zero adjust control has a range of +/-20pF, which should be more than enough to compensate for the residual capacitance in most test setups, plus any likely calibration drift.

Clamp meter

Following on with the theme of dedicated but affordable handheld meters, Jaycar's QM1560 digital clamp meter is priced at $79.50, which is less than many DMM clamp meter *adaptors*, as it happens. For that outlay, you get a pocket-sized (overall 180 x 60 x 28mm) clamp meter with a 10mm-high 3.5-digit readout, and the capability to read AC current up to 400 amps plus AC voltage to 500V. Incidentally it also includes a continuity checker, which sounds a buzzer when the measured resistance is less than about 650 ohms.

With just three modes of operation (amps, volts and continuity) and no ranges as such, the Jaytech QM1560 is a fairly basic instrument when compared to much more expensive handheld clamp meters. As you can see from the photo, it has a single sliding switch below the display to select between the three operating modes, and the usual scissor-action current clamp mechanism at the top of the unit. The bottom of the case has two banana sockets for the supplied test leads, which are used in a conventional fashion for both the AC voltage and continuity measurements.

The QM1560 also features a data 'hold' button on the side of the case, which will lock the display at the current reading so it can be viewed at a later stage. This is quite handy for the instrument's AC current measuring function in particular, since in many practical situations its AC current clamp must be used on an almost inaccessible wire, where the reading on the LCD screen may not be visible. After pushing the hold button, the meter can be extracted from that location and the reading taken.

With a quoted accuracy of +/-1% and a simple fixed range setup for current, voltage and continuity, I'd expect that that the Jaytech QM1560 would be a logical choice for those on a budget who need to do quick AC measurements with a minimum of fuss. All in all, it's quite a neat and useful little unit.

Trying them out

Being quite dedicated instruments with very few of controls and ranges, it was no real surprise to find both Jaytech meters easy to operate, with no doubt as to the function of each switch or control. The QM1572 capacitance meter in particular was a pleasure to use, thanks to the clear panel legends, positive switch action and large-digit display — I'm a sucker for *big* clear displays.

The Jaytech QM1560 clamp meter has very few controls, making it quick and easy to operate. Here, you can just see the display hold button on its right-hand face, alongside the display.

The QM1560 clamp meter also performed well in practical tests, with its main attributes being compact size and simple control setup. On the negative side, the current clamp jaws seemed a little imprecise in their closing operation when compared to more expensive units, but just how this may have effected its overall performance is difficult to tell.

In accuracy terms though, lab tests showed that both meters met their specifications with relative ease. The QM1572 capacitance meter turned in a commendable performance, with the reliability of its readings at the low end of its range (less than 200pF) really depending upon the accuracy of the zero set adjustment, as you would expect.

The QM1560 clamp meter also performed well, with only very low readings falling below the rated accuracy. This is presumably where the limitations of the inductive clamp pickup system come into play, and represents a characteristic of the type of meter by the way, rather than of this particular unit. By all accounts, covering a 0 - 400A span in a single range is not a bad effort...

All in all then, I found both the Jaytech QM1572 capacitance meter and QM1560 AC clamp meter easy to use and capable of producing quick measurements of more than adequate accuracy. Priced at $89.50 and $79.50 respectively, they appear to represent excellent value for money, particularly when compared to the equivalent meters from the large well-known instrument manufacturers. ❖

Jaytech QM1572 Capacitance Meter

A dedicated capacitance meter with a 3.5-digit LCD readout, nine ranges and a zero set control. Measures capacitance from a few pF to 19,999uF.

Good points: Large high-contrast LCD display.

Bad points: None, really.

RRP: $89.50

Available: All Jaycar stores

Jaytech QM1560 AC Clamp Meter

A small handheld meter equipped with a scissor-action inductive pickup clamp for measuring AC current (up to 400A) in a single-wire. Can also measure AC voltages up to 500V, and has a continuity checking mode.

Good points: Small, handy and very easy to use. Low in cost.

Bad points: Slightly vague current clamp mechanism.

RRP: $79.50

Available: All Jaycar stores

NEW PRODUCTS

OTDR has 40dB dynamic range

Wandel & Goltermann's new OFT-50 B optical time-domain reflectomer (OTDR) is intended for testing long fibre-optic links and has 40dB dynamic range. The device is useful for verifying fibre networks with path links ranging up to 200km, and has 0.25m resolution over the entire path range. It is available with lasers for 1310/1550 or 1625nm wavelengths.

A complete macro recorder function is a new feature of the OFT-50 B. All operating steps can be recorded during the testing of a fibre. Subsequent fibres can then be tested fully automatically. Another first is automatic Pass/Fail assessment of single events or the entire path.

For more information circle **246** on the reader service card or contact Wandel & Goltermann, 42 Clarendon Street, South Melbourne 3205.

Handheld 27MHz CB TXR offers SSB

The Mundara SY-201 27MHz handheld CB transceiver offers many innovative features, including both upper and lower single-sideband (SSB) modes as well as the conventional AM. As SSB transmission on the 27MHz band provides excellent propagation characteristics in mountainous and rugged terrain (considerably better than UHF FM CB), this is said to make the Mundara very suitable for use by bushwalkers, cross-country skiers, deer stalkers and emergency rescue personnel. It is also suitable for marine and mining use.

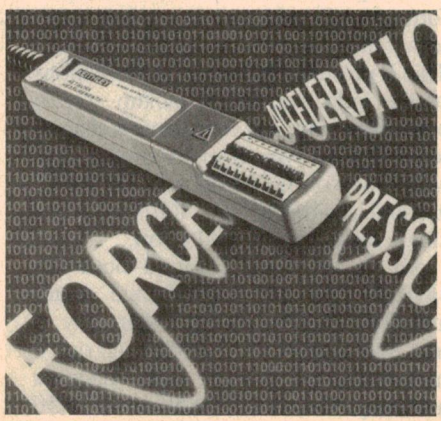
The SY-201 offers operation on the full 40 channels and provides five memory channels. It provides 4W PEP output in SSB mode and 4W in AM. An LCD readout shows the operating channel or frequency, and there is also an emergency channel 9 button. The unit also has provision for an external speaker-microphone. The 'rubber ducky' antenna provided connects via a standard BNC socket and can be replaced with a larger antenna for longer range.

Extensive use of surface mount technology makes the Mundara SY-201 very small and light compared with other 27MHz transceivers. It is also ACA compliant (AS/NZ 4355-1995). It carries an RRP of $399.

For more information circle **242** on the reader service card or contact GFS Electronics, PO Box 97, Mitcham 3132.

Miniature force, acceleration meter

Keithley Instruments has released the KNM-DYN12, a new addition to its SmartLink Series of miniaturised instruments. The KNM-DYN12 can make laboratory grade measurements of force, acceleration and dynamic pressure in virtually any plant location. Because the unit is so small (170 x 33 x 30mm) it can be located very close to demanding signals and sensors, minimising lead length errors and induced electrical noise.



The instrument accepts up to eight transducer or digital inputs. Possible measurement configurations include eight two-wire analog inputs of pressure, force and acceleration using low impedance, voltage mode piezoelectric sensors. Alternatively it can also accommodate up to four inputs of very low frequency or static acceleration using capacitive sensors. One channel is available for a thermistor input, which allows for temperature compensated measurements.

Measurements made by the KNM-DYN12 can be linked to a remote PC or controller or the user can display/store results for local monitoring and debug via a digital readout device or palmtop PC.

For more information circle **247** on the reader service card or contact Scientific Devices Australia, 118 Atkinson Street, Oakleigh 3166.

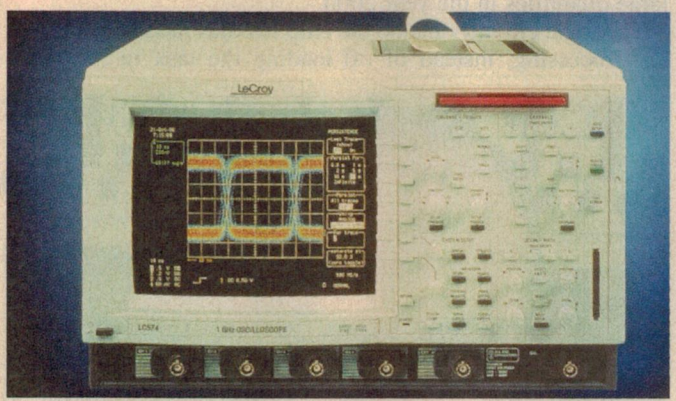
High performance 1GS/s arb generators

The new Tektronix AWG 510 and AWG 520 arbitrary waveform generators boast a one-gigasample/second (GS/s) clock rate and can output just about any real-world analog or digital signal imaginable.

The AWG 500 Series can simulate such real-world signal degradation as noise, jitter and fading. Using an integrated hardware noise generator, the AWG 500 Series is claimed to be the first family of signal sources capable of generating truly random white noise. In addition, engineers can simulate jitter with up to 2ns of timing resolution.

The AWG 500 Series offers a wide variety of editing features. Engineers can choose from a graphical editor, several digital and analog filters, and a powerful script editor. The script editor creates mathematically precise waveforms using polynomial equations, while an intuitive programming language is included for increased flexibility. It is also possible to build a signal from many waveform segments using the real-time sequencing feature standard to the AWG 500 Series. Infinitely long serial data stream outputs are possible, effectively extending the record length beyond memory limitations.

For further information circle **241** on the reader service card or contact Tektronix Australia, 80 Waterloo Road, North Ryde 2113.



Software turns DSOs into dedicated testers

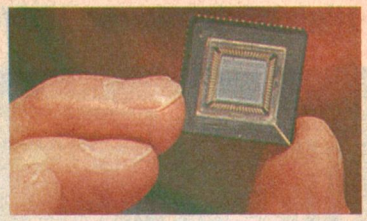
LeCroy has introduced a program module — loaded or unloaded at the flick of switch — which literally takes over control of a DSO, concentrating its operation onto a specialised, dedicated application. The program module released is a dedicated Mask Tester, whose unique 'finder' engine can locate any isolated pulse, given unlimited flexibility in the description of the matching pattern in a random bit sample.

The Mask Tester package loads masks and panel setups in a single action, uses automatic parameters to normalise or do mask-to-signal autosetup, and performs attenuation and offset adjustments to the strictest standards. Also included in the package are all coax and twisted-pair adapters needed for correct termination and amplitude scaling.

LeCroy got the idea for its module after learning that most DSO users regularly use only one or two of the instrument's advanced functions. The rest of these functions can 'get in the way' of the scope's user interface when not needed. The Mask Tester package supports most ANTI T1.103 or ITU G.703 electrical masks.

For more information circle **245** on the reader service card or contact Philips Test & Measurement, 34 Waterloo Road, North Ryde 2113. ❖

Silicon Valley NEWSLETTER



DEC chips to break 1GHz in 2000

Digital Equipment has introduced the first products in a third-generation Alpha processor family that is expected to exceed operating speeds of more than 1 gigahertz (1000MHz) in the year 2000. The first in the family of third-generation Alpha 21264 RISC processors are already shipping in sample quantity to customers, with volume production later this year. The chips will run both UNIX, OpenVMS and Windows NT operating systems.

According to Harry Copperman, senior VP and group executive of the Digital Products Division, the Alpha 21264 chips deliver up to five times the highest performance of any architecture available now. The first two chips in the series will offer performance of 40 SPECint95 and 60 SPECfp95.

A 100 SPECint95 version running at 1GHz is scheduled for production in the year 2000, Copperman said. "The new Alpha 21264 generation is an integral part of our dual platform strategy. Digital is fully committed to developing future generations of the Alpha architecture and extending its performance leadership for the most demanding applications, such as the technology-hungry digital special effects market", he added.

The first Alpha 21264 processors use a 0.35um six-layer-metal CMOS process and feature a 2.0V core. Over the next few years, the series will migrate to 0.25um and 0.18um process technology. Each chip will contain 15.2 million transistors. The 21264 chip's superscalar, deeply pipelined design enables up to four instructions per clock cycle to be issued to four integer execution units and two floating point units.

The 21264 instruction set includes Motion Video Instructions (MVI) that enables the Alpha chip to perform complex multimedia functions in software that currently require expensive add-in cards costing up to US$10,000. For example, the 21264 will be able to compress DVD video using the MPEG2 video standard and Dolby AC3 audio standard in software and in full real-time.

IBM: We have 1GHz now!

One day after Digital Equipment said it is working on a 1GHz microprocessor to be available in the year 2000, IBM said its researchers have not only designed a chip with such immense processing power — they have built a working prototype of the circuit that runs at speeds in excess of one billion cycles per second.

The new IBM chip's core is based on a PowerPC design and uses current chip manufacturing technologies. Mark Dean, director of IBM's Austin Research Lab in Texas said the latter is important as it shows that silicon-based IC technologies will be able to power several more generations of components. "We believe it's an important achievement for the Lab and for IBM. With this, the industry can breathe a sigh of relief."

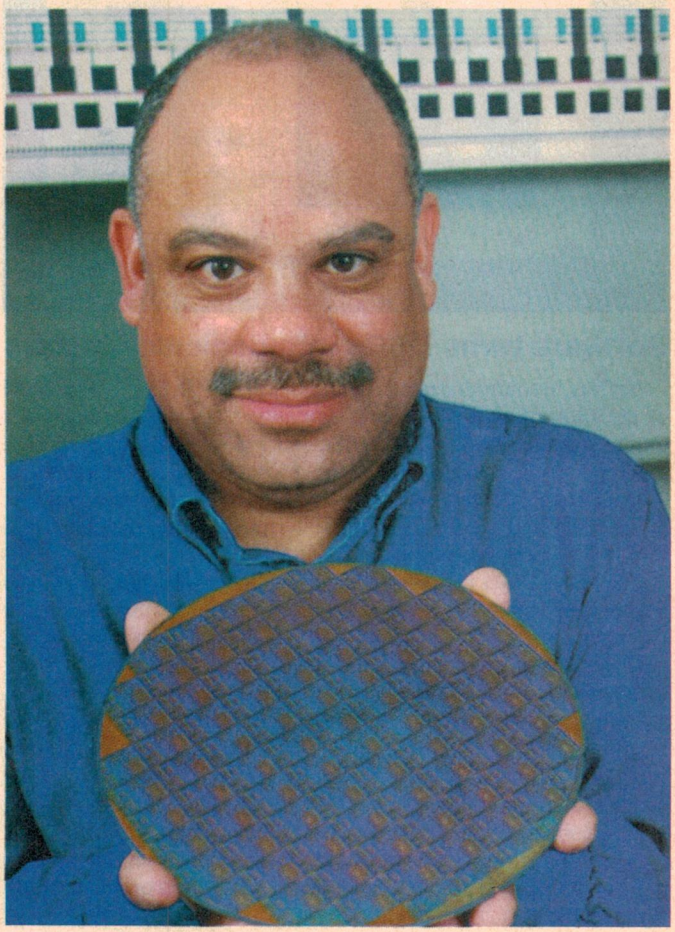
The IBM chip was developed at the company's research facilities in Austin and produced at an IBM chip production facility in Fishkill, New York. It uses the company's new copper-based interconnect process technology, which replaces the traditional aluminum based connections between different parts of the chip with copper, a much superior conductor. IBM said its chip operates at about the same temperature range as current microprocessors.

NEC develops new DRAM

In Tokyo, NEC researchers have announced the development of a new memory architecture that could lead to significant improvements in the ability of standard PCs to handle complex graphics and multimedia applications without a need for addition CPU processing power.

The chip's architecture combines traditional dynamic random access memory (DRAM) with logic circuitry and takes advantage of data compression/decompression hardware. The so-called 'logic-combined DRAM' circuits will be available in large quantities in the year 2000.

The logic circuitry inside the chip handles media and graphics processing, instead of off-loading the task to the CPU.



An engineer at IBM's Austin Research Lab in Texas displays a wafer of experimental 1GHz CMOS processor chips, fabricated at the company's plant in East Fishkill, NY using its new copper-interconnect technology...

Thus the chip vastly reduces the volume of data transmission over its memory bus which is compatible with the new architecture. Because the bus enables graphics data transmission in a compressed data format, the memory chip also solves the bottleneck problem in the memory bus that causes graphics and multimedia applications to perform poorly on most of today's PCs.

Japan's chipmakers excluded by Sematech

Sematech, the 10-year-old US semiconductor research consortium, has reached a pact with European, Korean, and Taiwanese chipmakers to join the group's effort to develop the chip production technology for next-generation IC manufacturing.

The new group will be known as International Sematech and will focus its early development efforts in the area of lithography and 300mm technology and equipment.

The SIA said the expansion, for the time being, is limited to the companies who joined Sematech's original 300mm development program. Japanese chipmakers reportedly were not invited to join International Sematech. Two years ago, the Japanese chip industry declined the invitation to join Sematech's 'i300i' program and instead initiated a similar program known as the Semiconductor Leading Edge Technologies Inc (SELETE).

Seagate lays off 10,000

Disk Drive market leader Seagate Technology is chopping its global workforce of around 100,000 people by 10,000, in an effort to stop the flow of red ink at the Scotts Valley-based company. The bulk of the cuts will be made in Singapore and Malaysia where some 7500 jobs will be eliminated, adding further woes to the already deepening crisis in the economies of the Pacific Rim countries. Another 1250 jobs will be cut at Seagate facilities in both the United States and Ireland.

HP now tops the workstation market

For the first time since its inception in the early 1980s, the US$15.8 billion global workstation market has a new leader: Hewlett-Packard of Palo Alto. According to International Data Corporation its latest survey of the workstation market, including both traditional UNIX systems and PC-based machines running Windows NT, showed HP surpassed Sun Microsystems in 1997. HP sold a total of 330,559 workstations in 1997, a 43% jump from 1996 unit shipments. Sun saw its unit sales decline 3.3% to 285,815.

In addition to becoming the overall leader in the workstation market, HP also became the largest supplier of PC-based workstations, a position previously held by Compaq. HP's NT-based workstations sales swelled to 222,994 units, compared with the 199,700 systems Compaq sold.

Sun Microsystems remains the undisputed market leader in UNIX-based workstations, outselling HP almost 3:1 in this area. Sun has resisted entering the NT-based workstation market.

9.8 million 300mm wafers in 2002

Production of 300mm (12") silicon wafers will exceed 9.8 million units annually by the end of 2002, according to a report by The Information Network, a Williamsburg, Virginia-based market research company.

Chemicals and Materials for Sub-0.5 Micron IC Processing forecasts a total of 223 million wafers to be produced in 2002, up from 136 million in 1997. Together, the wafers will add up to 7.9 billion square inches of silicon. In 2002, 200mm wafers will dominate the chip production market with 73 million units compared with 30 million in 1997.

"Obviously 300mm wafer production of ICs has not started yet, as some of the non-vacuum production equipment is not yet available", said Dr Robert Castellano, president of The Information Network. "The 80,000 units produced in 1997 were all test wafers."

300mm wafers will remain pricey for some time. Today test wafers cost around US$1400 each, but by 2002 the wafers will fetch about US$400 each, thus making the larger wafer roughly equal in production cost to today's 200mm platters.

Intel launches 333MHz Pentium II

Intel has given power-hungry PC users a major new reason to consider upgrading to the next level of desktop computing power, when the Santa Clara chipmaker launched a 333MHz version of the Pentium II chip. At the same time it implemented significant new price cuts on older lines of processors.

The new P-II chip will sell for US$721 each in units of 1000 and, in the near terms, is aimed at the workstation and server market. Hewlett-Packard, Packard Bell, NEC and Gateway 2000 immediately launched the first new high-end models in their line that use the 333MHz chip. The systems carry prices starting as low as US$2800.

IBM to build 'ultra' Deep Blue

IBM has signed up the first customer for the next-generation of Deep Blue computers, machines that will be able to process between 30 and 100 trillion calculations per second.

A prototype of the RS/6000-based computer is expected to be completed in 2001 and will be used by the US Department of Energy to develop high-speed switching technology to simulate the effect of fires, earthquakes and other natural disasters on the US nuclear stockpile. ❖

Compaq buys Digital Equipment for US$9.6 billion

Digital Equipment Corporation, which entered the 1990s as the world's second largest computer company, has been swallowed whole by Compaq Computer — which in 1990 ranked a distant third in the personal computer market behind Apple Computer and IBM. Compaq has agreed to pay US$9.6 billion for Digital, half in stock and half in cash.

The merger, the largest in computer industry history, will create a conglomerate with US$38 billion in 1997 revenues and a product line that ranges from sub-$1000 PCs to workstations and servers to mini supercomputers. The acquisition will propel Compaq to compete with Hewlett-Packard for the number two ranking in the global computer market.

While still at only half of IBM's annual sales of US$78.5 billion, analysts said Compaq may surpass IBM in size in the next four to six years if the company maintains the breakneck growth pace it has shown during the 1990s. Compaq CEO Eckhardt Pfeiffer recently predicted Compaq would reach revenues of US$50 billion by the end of 2000. With the Digital merger, the company's sales volume may be close to US$80 billion.

The Compaq-DEC merger will likely have major repercussions for the overall computer industry. Digital will vastly expand Compaq's already fast-growing position in the corporate computing market. For one, Compaq is likely to bring a new level of aggressive pricing to the server and workstation markets where companies such as Hewlett-Packard, Sun Microsystems, and IBM have enjoyed some of the highest profit margins in the computer market.

Video image capture device review:

THE ZIPSHOT

Transferring an image from a video source to a computer has always taken a fair amount of doing. Large ISA-bus cards used to be the norm (with prices to suit), but in recent years things have improved dramatically and as you can see from the photos, you can now get a small, compact unit which can capture video shots quickly and easily. Captured image resolutions of up to 1600 x 1200 are not out of the question, and with full colour previews updated at three frames a second, the Zipshot offers a lot of features at a reasonable price.

by GRAHAM CATTLEY

The traditional term used to describe this sort of device is 'frame grabber'. This was a crude but fairly accurate term at the time, but you won't see it used in any of the literature supplied with the Zipshot — 'The Complete Still Image/Motion Video Capture Solution' was about as close as I could get to a term I could use, and I suppose they have a point.

Frame grabbers have come a long way since their first incarnation of big expensive boards that fitted into your computer, and the number of features available from this little box that plugs into your parallel port is quite impressive. The Zipshot offers a 320 x 240 pixel full colour preview image updated once a second, with full control over brightness, contrast, hue and saturation *before* you capture the shot. The update rate can be increased to approximately three frames a second if you go for a smaller preview screen, and you can select from a range of five resolutions for the final image: from 320 x 240 to 1600 x 1200 pixels in eight to 32-bit colour.

The Zipshot looks not unlike a point and click pocket camera, with a sculpted front panel and a row of connectors along the top edge. You get two RCA sockets for composite video in and out, a standard four pin S-video socket along with a DC power socket. The right hand end sports a DB25 plug that connects to the computer's parallel port, while the left hand end provides a parallel port pass-through connector so that you can still print while the Zipshot is connected. Power is derived from a keyboard T-piece connector, with both the standard AT style and the smaller PS2 style adapters included for newer machines.

A large swag of cables is supplied with the Zipshot, including a high quality parallel cable, a generous two-metre video cable, and the two power adapter cables mentioned above. You also get a 33-page user's manual and a fair sized bundle of software with its own manual. The one thing not supplied was an S-video cable, so you'd be looking at buying one of these if you intend to use the higher quality output from your video camera or VCR.

As you can see, you get quite an acceptable preview image (320 x 240), updated once a second. The setup panel on the right gives you full control over the image before you grab it. It also allows you to configure the Zipshot for time-lapse recording as well.

Giving it a shot

After reading through the user's guide I had no trouble setting up and connecting the Zipshot to my computer system. The manual is aimed at the complete novice and covers everything from identifying the parallel port to connecting a video source and running printers via the pass-through port. There's also a comprehensive troubleshooting guide that seemed to cover almost any type of problem you might encounter.

Installing the software was the next step, and I elected to install the whole lot (off a CD-ROM) as I wasn't sure which application installed the Zipshot TWAIN drivers needed if you want to use the device in another application. A total of five software packages were installed, including PhotoImpression which is the main image acquisition and manipulation application. The others were PhotoPrinter, a utility to print multiple photos on one page; Multimedia Email, for sending images, sounds and video clips via email; LiveCom, a

The Zipshot comes with everything you need to get you going out of the box, including a suite of image editing and internet/email software.

video conferencing package, and finally PhotoFantasy, where you can superimpose shots of your friends(?) and family onto a variety of fictional magazine covers.

As far as actually grabbing frames goes, the Zipshot performed admirably. It can handle PAL, M-PAL, N-PAL, NTSC and SECAM video formats (as well as S-video), can grab frames at up to 15fps and can even be programmed for time-lapse frame capture.

This last feature opens up a very interesting side of frame grabbing, as you can set up the software to capture an image (from a video camera) at anything from 10 frames a minute (at 320 x 240) over a 24-hour period and store the results to disk. Of course you'd need a fair amount of space free to store the images, but it shows the flexibility of the arrangement.

One thing that I particularly wanted to try was Zipshot's TWAIN interface. After I had played around with the supplied applications, I fired up my favorite image editing program (Adobe Photoshop) and tried selecting the Zipshot as a TWAIN-32 source.

Sure enough, the familiar image acquisition screen popped up, where I had full control over every aspect of the capture, and the resulting image was transferred seemlessly back into Photoshop.

All up then, I was more than pleased with Zipshot's performance. It was easy to set up, easy to use, and it performed well. Recommended. ❖

Zipshot

Video capture device for PCs that connects via the parallel port.

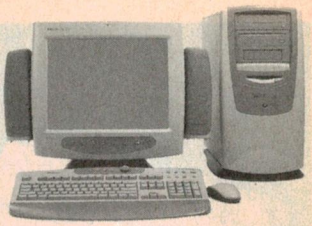
Good points: Simple, effective and fast. Good colour and resolution options.

Bad points: No S-video cable supplied.

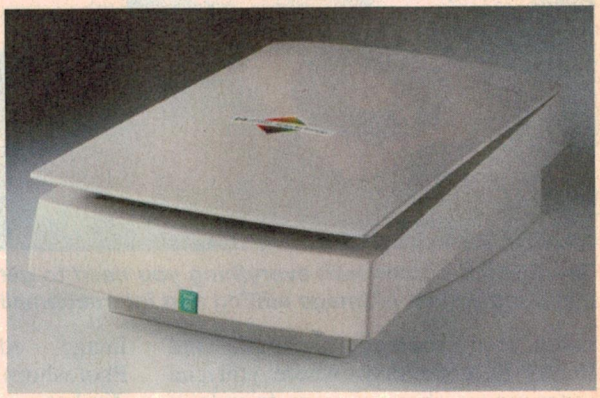
RRP: $329 (inc. tax).

Available: MicroGram Computers, 1/14 Bon Mace Close, Berkeley Vale, NSW 2261; Phone (02) 4389 8444, or fax on (02) 4389 8388. Web site at **http://www.mgram.com.au**.

Computer News and New Products



New intelligent scanner from HP



Hewlett-Packard's new ScanJet 5100C colour flatbed scanner uses the company's Intelligent Scanning Technology and is said to make exceptional photo-quality scanning easy and automatic — even for users with no previous scanning experience. The scanner is the first to scan and optimize every element of a page simultaneously, so users have a 'finished' scan ready for direct placement into the most commonly used desktop applications.

The ScanJet 5100C scanner is expected to sell in Australia for an estimated street price of $507. It's HP's first flatbed scanner to connect through a parallel interface, making it as easy to install as a desktop printer.

With other scanners, users typically have to complete several steps to achieve a scan resembling the original. With the ScanJet 5100C, a single button press initiates a sequence wherein a page analysis first sets the resolution, bit-depth and file format for each individual page element, (text, photos, color/black and white line art), and optimizes each for the desired application and printer; scanning is then done. Black-and-white logos and drawings are turned into clip art to appear as sharp and clean as the original image, with no jagged effects or loss in quality. These scanned images have infinite scaling capability. Original page layout, form and content are retained after the scan, eliminating the need to rebuild or reformat in most word processing packages. The page is also 'de-skewed', and all images are straightened automatically.

A CD-ROM containing scanning software ships with the ScanJet 5100C. Included are HP PrecisionScan for one-step scanning, with fully automated optical character recognition (OCR) with Caere's OmniPage, HP ScanJet Copy Utility for scanning documents directly to a printer, Adobe PhotoDeluxe 2.0 for image editing and publishing and Caere's PageKeeper Lite for paper and electronic document management.

For more information circle **160** on the reader service card or call HP Australia's Customer Information Centre on 131347.

PC-based or independent data acquisition

IOtech's new Logbook/300 is a portable, intelligent, PC-based data acquisition system that can operate without an attached PC. It contains an embedded 486 processor and is capable of executing programs and storing acquired data using off-the-shelf, low-cost, removable PC-Card memory.

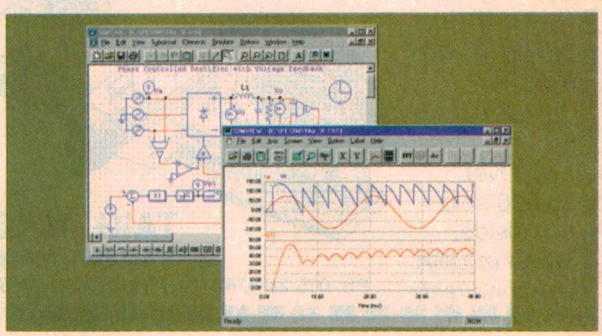
The product combines high-speed sampling (100kHz), high-channel capacity (more than 450 analog and digital channels) and low cost. Also, its compact size (basic system size is smaller than a notebook PC), allows its use in a variety of portable and field applications where size and weight are important factors.

The basic system features a 16-bit, 100kHz A/D converter, 16 single-ended or eight differential analog inputs, 40 digital I/O lines, four frequency inputs, two pulse train outputs, and four optional highspeed 16-bit analog outputs.

Included with the product is LogView Out-of-the-Box software, IOtech's new data acquisition and display software which provides fast, easy set-up with no programming required.

For more information circle **162** on the reader service card or contact Scientific Devices, 118 Atkinson Street, Oakleigh 3166.

Power electronics circuit simulator

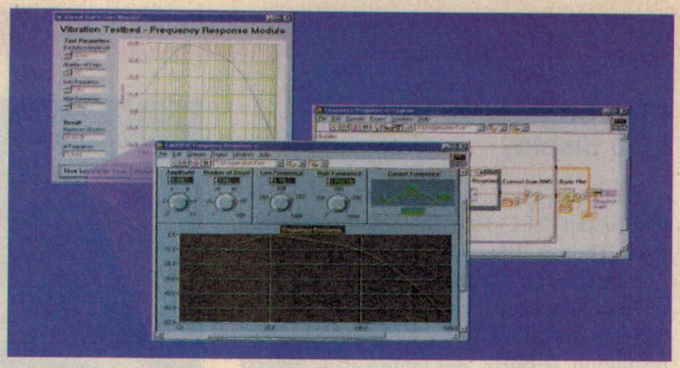


The Power Electronics circuit simulation software (PESIM) from Lab-Volt is a computer simulation package specially designed for power electronics circuit design and analysis. With fast simulation, user-friendly interface and waveform processing, PESIM is both a powerful simulation environment and a useful learning tool.

The PESIM package consists of three programs: the circuit schematic editor SIMCAD, the PESIM simulator and the waveform processing program SIMVIEW.

For more information circle **165** on the reader service card or contact Lab-Volt, PO Box 289, Ingleburn 2565.

National releases LabVIEW 5.0



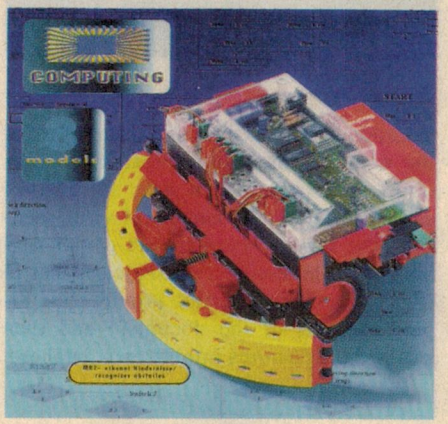
National Instruments has released Version 5.0 of the company's award-winning LabVIEW graphical instrumentation software. LabVIEW 5.0 combines the power of the latest software technologies together with the simplicity of graphical programming to give users the power to develop their solutions quickly and easily.

The new version delivers many powerful technologies, including multithreading, instrument 'wizards', ActiveX container, automation and a TCP/IP server, distributed computing tools, translation and documentation tools, graphical differencing tools and programmatic menu bars and undo.

Both novice and expert users are expected to benefit from these new features as they develop faster and more reliable measurement and automation applications that take advantage of industry-standard technologies. LabVIEW Version 5.0 is available for Windows NT/95/3.1, Mac OS, Solaris, HP-UX, and Concurrent PowerMAX.

For more information circle **161** on the reader service card or contact National Instruments Australia, PO Box 466, Ringwood 3134.

Robotic construction kit



Fischertechnik has released a new computer-controlled robotic construction kit called Mobile Robots. The kit provides over 300 parts with a 34-page manual and additional information on CD-ROM, describing the construction of eight models. These models include a sliding door, pulse counter, stamping machine and mobile robots that can detect obstacles, detect the edge of a table, follow a source of light or follow a path drawn on the floor.

Previous mobile robot kits manufactured by fischertechnik were tied to the computer by ribbon cable. This kit provides a battery-operated 'intelligent' interface which contains a microcomputer capable of accepting a program 'downloaded' from a personal computer for complete mobile freedom. The 30402 interface provides eight digital inputs, two analog inputs and four bi-directional motor outputs, and connects to the serial port (COM 1 or 2) of any IBM-PC compatible computer.

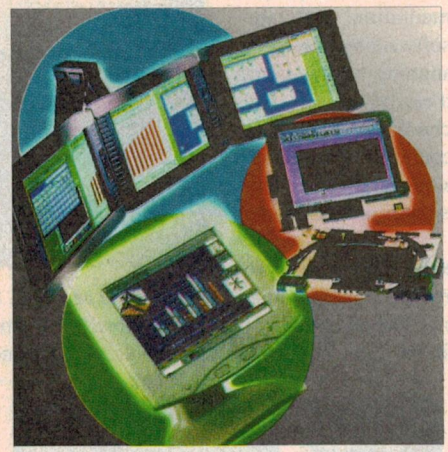
The fischertechnik software, called Lucky Logic for Windows (LLWIN), provides a flowchart style of programming language, which is ideal for 'real-time' machine control.

For more information circle **163** on the reader service card or contact Procon Technology, PO Box 655, Mount Waverley 3149.

High brightness TFT LCD display

A high brightness TFT LCD display unit, the Model TLC-104ET is now available from Thomas Electronics of Australia Ptv Ltd. Originally developed by the company for avionics use, the compact display unit features a 10.4" TFT LCD with 640 x 480 resolution at 60Hz and comes in a rugged aluminium casing.

The TLC-104ET features an analog controller card which enables the user to connect directly to the output of any standard analog VGA port. Other features include 256,000 colours, backlighting and 250 nits brightness. Supplied with industry standard 15-pin connector, the unit is designed for immediate 'plug and play'. No special software driver is required.



In addition to the controller PCB, the unit comes complete with backlight inverter, contrast and brightness user controls and microprocessor based on-screen display (OSD) for full user control. The use of surface mount technology gives the unit the minimum possible depth.

Power requirements are 28V DC at 20W and can be customised for any power source.

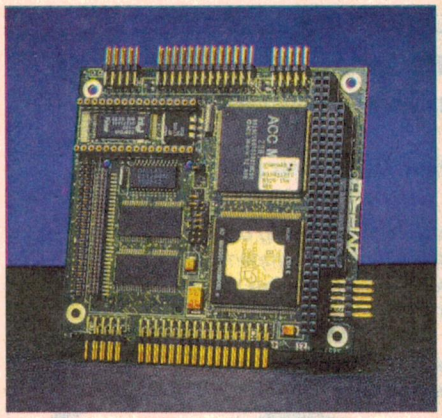
For more information circle **167** on the reader service card or contact Thomas Electronics, 13 Larkin Street, Riverwood 2210.

VirusBuster upgrade

Australian anti-virus specialist Leprechaun Software has just released its new Windows 95/NT version of VirusBuster. Part of this release has been a revamp of their old box and the inclusion of the revolutionary MacroVirusBuster, the macro scanner which no longer needs updating.

Leprechaun MD Jack Kenyon says that the new version features real time scanning, enabling today's user to practise safer and more automated anti-virus security. The revolutionary feature of this new version is the use of a heuristic scanner in MacroVirusBuster, which provides intelligent analysis of the document and then stores the signatures into its own database. This new bonus feature is important as the spread of Macro Viruses via the Internet is becoming far more common. MacroVirusBuster is claimed to be practically 100% effective in combating these viruses.

For more information circle **166** on the reader service card or contact Leprechaun Software, 75 Redland Bay Road, Capalaba 4157.



Embedded PCs run Windows CE

Ampro Computers Inc. has announced a collaboration among Ampro, Annasoft and M-Systems to support the new Microsoft Windows CE operating system on all of Ampro's popular Pentium and 486DX based embedded-PC products. Annasoft will be the source for CE licences for Ampro's OEM customers and will support their CE-related device driver requirements. M-System's role in the three-company alliance is to provide CE driver support for its highly rugged 2 to 72 megabyte DiskOnChip 2000 32-pin flash memory modules, which plug directly into Ampro's SBCs and serve as the CE boot and data storage drive.

Now in its 15th year, Ampro Computers is a leading manufacturer of PC-compatible computer modules tailored to embedded applications. The company originated the PC/104 and PC/104-Plus standards, and co-authored (with Motorola) the EBX high-performance non-backplane SBC standard (based on Ampro's popular Little Board form factor).

For more information circle **164** on the reader service card or contact Micromax, 307 Keira Street, Wollongong 2500. ❖

WEBWATCH

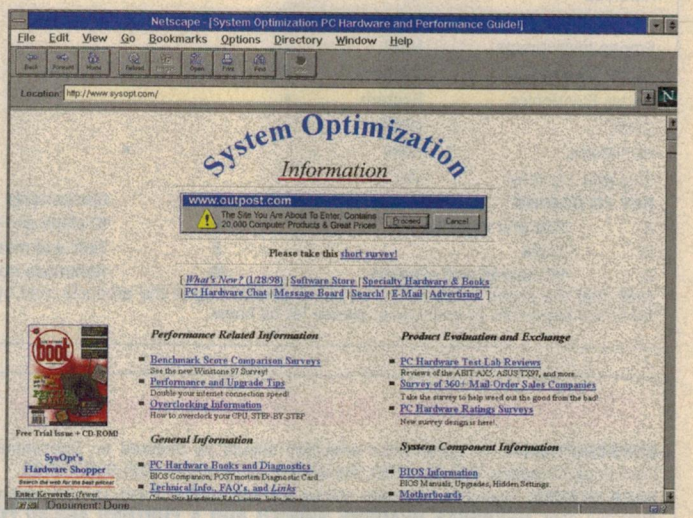
presented by GRAHAM CATTLEY

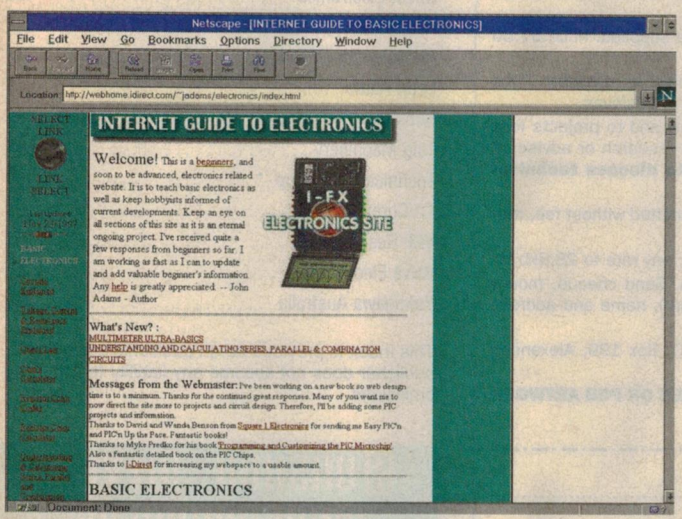
The system optimisation page

http://www.sysopt.com

At first I passed this site over, in the belief that it would run along the path of configuring your operating system to give optimum performance. On closer inspection however, I found a wealth of information on almost every aspect of your computer's hardware. There's lots of juicy stuff on fake cache RAM, how to access hidden settings in your BIOS, everything you wanted to know about overclocking your CPU or video card, details on motherboards, FAQs, links, reviews, benchmarks, hardware, RAM, CPU comparisons and — well, you get the idea.

Yes, there's heaps of stuff here. More than enough to keep you occupied for a couple of hours at least, and with an average of two million hits a month, this site obviously has a lot to offer. It's a bit commercial in places, with some pages tempting you with books or diagnostic hardware; but with the high concentration of useful, practical and otherwise hard to find information, you don't really mind. And anyway, some of those books look interesting... Go, look, learn and enjoy.





Internet guide to electronics

http://pobox.com/~electronics

John Addams has set up this site, aimed more or less at beginners in electronics, and a pretty good job of it he has done too.

The emphasis is on basic electronics, and most of the topics (each covered on their own sub page) start from the ground up. Things like what to look for when buying a multimeter, or the interactive resistor colour code calculator make this site quite appealing to someone starting out in the field.

There are various other circuit calculators (some of which require a Java-capable browser), and a useful set of pages on passive and active components. John provides a page of 'Lectric Links', and a list of recommended electronics books as well.

The only thing against it as far as I could see was that the diagram attempting to explain resistance was misleading in the extreme, and would give a newcomer the wrong idea about current flow. This aside, I found the rest of the site interesting and informative, and would recommend it to someone just starting out in electronics.

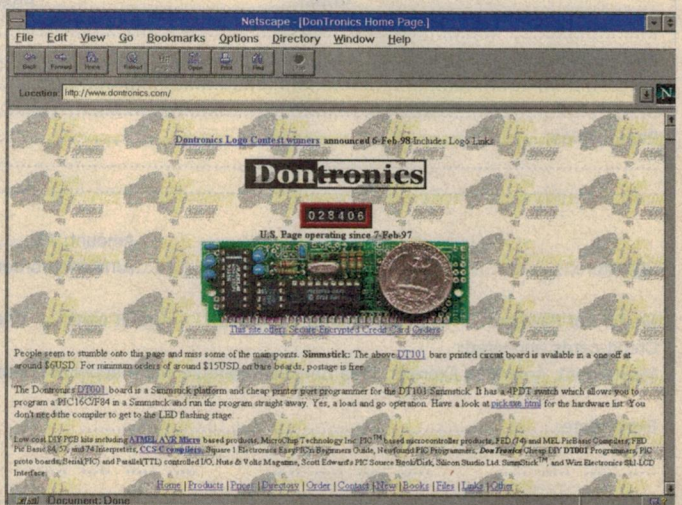
Pic of the PICs

http://dontronics.com

This site is run by Don McKenzie, and it's aimed fairly and squarely at the PIC and microcontroller enthusiast. Over the years, Dontronics has become known as the place to go for PICs and related hardware, and Don's latest product gets pride of place at the top of his page. The Simmstick is essentially a PIC16C/F84 and support circuitry mounted on a PCB the size and shape of a 30-pin SIMM. There are details of other PIC based kits from other sources, and info on a very useful serial interface for LCD panels.

As well as hardware, the Dontronics site contains heaps of files in 'Don's Download Dungeon', which include almost every compiler assembler, editor, and tool you can think of. You can also buy commercial development systems through the site, as well as get in touch with the software developers.

If you like, you can download the entire site in compressed form and view it later — a great idea, as this site offers a lot and you can then take your time going through it all. ❖



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KEY TO CODING

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The best "value for money" CCD camera on the market! Tiny CCD camera, 0.1 lux,IR responsive, high resolution. It has a metal lens housing and glass lenses, & performs better than many cheaper models.

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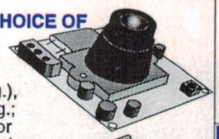
WITH YOUR CHOICE OF ONE OF THE FOLLOWING LENS
Pinhole (60deg.), 78 deg.; 92 deg.; 120 deg.; $89 or $99 with a 150 deg.



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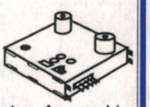
A small plastic case suitable for enclosing the CCD camera, plus a very strong multi angle and position adjustable universal joint swivel bracket plus screws: $4

UHF A-V MODULATOR
Professional stable design PLL, tuneable UHF A/V modulator with built in Antenna booster and a test pattern generator: As used in VCR's. With each unit we also supply parts for a 5V regulator $18



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Metal enclosed with telescopic antenna, A/V leads supplied: $30

AUDIO PREAMPLIFIER
Small kit which includes a microphone. Gives Line level output for use with the above Modulator or transmitter: $6

AUDIO POWER AMPLIFIER KIT
A small LM386 based power amplifier kit that can directly drive a speaker, needs the above Preamplifier: $8

TIME LAPSE RECORDING INTERFACE
New kit, now has relay contact outputs! Can be directly connected to a VCR or via a learning remote control: $35

PIR MOVEMENT DETECTOR module to suit,very small: $16

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10 LED: $14 - $10, 30 LED: $30 -$20

HIGH RESOLUTION MONITOR
Brand new 240V 30cm enclosed computer monitor + a video conversion kit. Gives better resolution than TV's!! Avail. early Feb. Limited but good qty.
BARGAIN PRICE.

MINIATURE FM TRANSMITTER
(33 x 23 x 10mm) enclosed in a small black metal case. Built in switch & microphone. Specifications: 88 to 108-MHz (adjustable), has a wire ant. attached, bat. life 60 hrs, Range 50M: $39 (Std. watch battery LR44, inc.)

***** SPECIAL *****
MASTHEAD AMPLIFIER KIT
Our famous MAR-6 based masthead amp. Frequencies up to 2Ghz. 2 section PCB (power supply section. can be indoors): Kit includes Plugpack: and two Weather-proof boxes: $24. Rabbit-ears ant: $7 (MAR-6 avail. separately)

DOG SILENCER NEW IMPROVED KIT
High power swept ultrasonic generator kit that can drive up to 4 piezo tweeters. Works on dogs & most animals. PCB & all on-board components and horn piezo tweeter: $33, extra tweeters $7 ea. Suitable 13.8V-1A DC plugpack $10.

SWITCH MODE POWER SUPPLY
Compact (145 X 80 X 50mm), in a perforated metal case, 240V AC in, 12V DC/2A and 5VDC/5A out: $17

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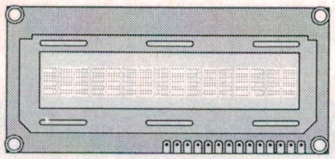
Fresh stock standard battery plus one **GEL/LEAD-ACID BATTERY CHARGER** for: $30

DEMO BOARD FOR LIQUID CRYSTAL DISPLAYS
The actual 16 x 1 character display used in a project in the S.C. March issue. No problems!!!: $16 Ea. or 3 for $40

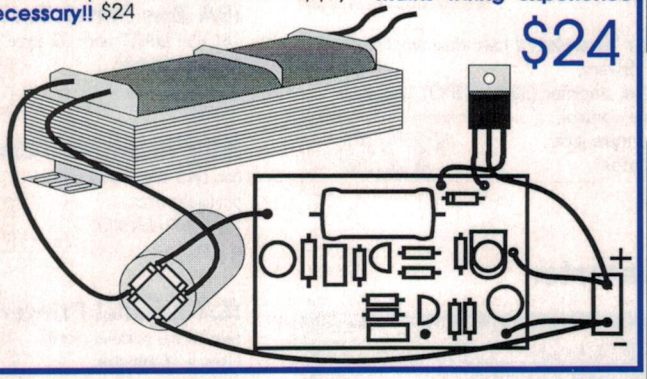


KIT OF THE MONTH

1.7-15V - 3.5A REGULATED POWER SUPPLY

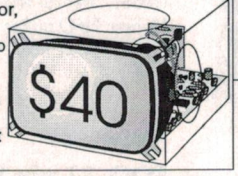
This unusual simple design uses a MOSFET as a series regulator to produce good results: * dropout voltage of 0.5V @ 2A *0.3% regulation from 0-2A load * 1.-15V output voltage *.5A current limit We supply a short form kit that includes a PCB and all on-board components diodes, transformer, large electrolytic capacitor and some metal suitable for the heat sink. The large electro. is used and two of the components are recovered from a new surplus PCB that we supply. **Mains wiring experience necessary!!** $24

$24



NETWORK 2 COMPUTERS FOR $50!!
New Windows/95 compatible (DEC (DE101) etherworks LC/TP) DIGITAL brand Ethernet computer cards with software and booklet in original box. Cards include boot ROM so one of the computers does not even require a hard disc. We don't supply the commonly available cable which can also be made up with RJ45 connectors and two twisted wire pairs: Diagram included. Limited quantity: $50 for a pair.

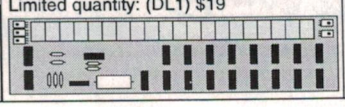
CGA COLOUR MONITOR
New 12V DC-1A 6" colour monitor, ready for enclosing, no box, just the tube and driver PCB's Down from $69 now just a low $40



DC MOTOR SPEED CONTROL EXPERIMENTERS PACK
ONE 20A motor speed controller kit (similar to SC - Jun.97-$18) plus two small new 12VDC motors (40mm dia., 40mm length) plus one used car windscreen wiper motor (which have internal gear reduction) for: $32

BRAND NEW LASER ENGINE
Laser engine as used in laser printers. With Polygon scanner motor with Xtal controlled driver PCB, 5mW/780nM laser diode in collimated housing, mirrors, lenses etc. Info on how to run motor and laser included: $35

MOVING MESSAGE DISPLAY PCB: Used, complete PCB assembly with bright dot matrix red LED displays and driver. Inc. twenty 74HC164 ICs. Has 20 displays in a line to form a continuous display. Display size is 280 x 18mmeach with 35 LED's (700 LED's!). , PCB 330 x 75mm. Needs external 5V supply. Inc. a simple program on disk and instructions to make the display scroll No "1" through all displays, via a computer parallel port. Limited quantity: (DL1) $19



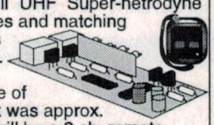
LASER POINTER KIT SPECIAL!!!
650nM 5mW, 3-4V, case 125 x 39 x 25mm, lens, battery holder NOW JUST:$25

VISIBLE LASER DIODE MODULE KIT
5mW/650nM The same as our "visible laser diode kit" but a much smaller PCB. Dimensions are 15mm X 40mm: $24

SWITCH MODE POWER SUPPLY
Compact (145 X 80 X 50mm), in a perforated metal case, 240V AC in, 12V DC/2A and 5VDC/5A out: $17

AUTOMATIC LASER LIGHT SHOW KIT
The display changes every 5-60 sec, Adjustable time. Countless possible displays from single to multiple flowers, collapsing circles, rotating single and multiple ellipses, stars, etc. PCB + all PCB components, three motors & mirrors : $65 Or with above kit for $79!!

LONG RANGE UHF REMOTE CONTROL
New very small UHF Super-hetrodyne receiver modules and matching Saw resonators on 433.92 MHz. (25mW power limit!).The range of our proto.Tx-Rx was approx. 1Km! The first will be a 2 ch. remote control. $65: (1 Tx + 1 Rx.)



REED SWITCHES NEW!!!
Quality "Bell telephone" brand 28mm x 3.5mm. A great buy at: 10 for $3

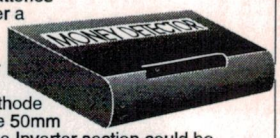
NEW SMALL 650nM LASER MODULE
laser diode module, 35x10mm diam. 3-4.5V: $32

STEREO FM TRANSMITTER KIT: 88-108MHz, 6-12V DC supply, 8mA @ 9V, 25 x 65mm PCB size, PCB plus all on-board components, plus battery connector and 2 electret microphones: (K94) $25

***** SPECIAL *****
GRAB THEM BEFORE THEY GO!!!
STILL THE BEST SOURCE OF LASER LIGHT FOR HOLIGRAPHY ETC.
HELIUM - NEON LASER TUBE & POTTED SUPPLY: Large 2-3mW laser head + compact potted US made power supply. Head plugs into the supply & connect to 240V mains.. Bargain: $65
WARNING!!! VERY BRIGHT NOT FOR USE BY CHILDREN!!!
ALL LASERS SHOULD BE USED UNDER COMPETENT SUPERVISION.

OPTICAL TACHOMETER KIT
Measures RPM of prop. shafts etc. wihtout physical contact. similar to the kit published in SC. (May 1988), but includes X-tal control calibrator. Use a DMM on 200mV or a 3 1/2 digit panel meter as the display PCB + all on-board components: $25.

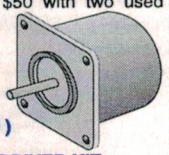
UV MONEY DETECTOR:
Pocket source of UV. This is a new used for checking for forged bank notes. (Australian bank note serial numbers fluoresce under UV. light) Also used in the fossicking and gem industry. Uses 2 x AA batteries to power a very simple inverter with a cold cathode UV tube 50mm long.The Inverter section could be used for experiments For example, it can be used to light up a 4W fluorescent tube for a dim white light source. Current consumption of unit is about 250mA. Case size 82 x 46 x 21mm: $6



MORE KITS
Geiger counter:$40,...Breath tester: $40,..Music box: $11,..Ding dong doorbell: $3.50, Siren using a 10cm speaker: $14,..Electric fence using used car coil: $25,..Ultrasonic car alarm: $35,..1ch UHF Central locking, Tx and Rx: $35,...4 door Central locking: $60,..2 Channel UHF Remote Control, 1Tx + 1Rx: $45.

MAGNIFIERS / LOUPES
jewellers eyepiece with a plastic lens: $3,... 50mm $8, 75mm $12,... 110mm $15. SPECIAL: The set of four for $25

****** TWO GREAT SPECIALS ******
*****STEPPER MOTOR DRIVER KITS*****
NEW!!! COMPUTER CONTROLLED STEPPER MOTOR KIT New improved kit that can drive larger motors and has optoisolation between the circuit and the computer. DB25 connector provided on PCB. Needs a standard DB25 cable for connection to a PC, and a power supply for the motor drive section. PCB and all on board components kit plus software and notes: $40 or $50 with two used 1.8deg. motors !!!
(ONE ONLY NEW MOTOR OF SIMILAR QUALITY TO THE ONE SUPPLIED COSTS OVER $100)



STEPPER MOTOR DRIVER KIT
Kit includes a large used 1.8deg. (200 step / rev) motor & uses SAA1042A IC.
(ONE OF THESE CHIPS WOULD RETAIL FOR ALMOST $19) Can be driven by external or an on-board clock; has a variable frequency clock generator. Ext switches (not inc) or logic levels from a computer etc set CW or CCW rotation, half or full step operation, operation enable/disable, clock speed. PCB and onboard components:$20 with 1 motor, $30 with 2 motors.

FLUORESCENT LIGHT HIGH FREQUENCY BALLASTS: European made, new , "slim line" cased high frequency (HF) electronic ballasts. They have flicker free starting, long tube life, high efficiency, no flicker during operation, reduced strobing with rotating machinery, no audible noise & generate much less radio interference than conventional ballasts. The design appears to be similar to that published in the Oct. 94 SC. in that a HF sine wave is used, but more complex. Some have a dimming option, requires either an external 100K pot or a 0-10V DC source. Some require the use of a separate filter choke that is supplied where req. Limited stock of new price!
Type G09E 2x32W-40W tubes, not dimmable, no filter, 44 x 4 x 3.5 cm: $18

Type G09H 1x32W-40W tube, dimmabe, filter used, 44 x 4 x 3.5cm: $14

**************ALL OF OUR KITS**************
All kits come with quality made PCB's with screen printed component designation & solder mask.

OATLEY ELECTRONICS
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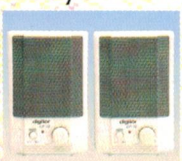
Where do you GO for the last word in electronics...

Let your Computer speak in stereo



These **Digitor Computer Speakers** feature separate left/right bass boost and volume controls, 2 x 3" drivers, 2 x 12W PMPO output. Optional 6V DC adaptor.
C 4198

$59.95

Koss Computer Speakers have dual amplified stereo speakers with 3.5" drivers, 4.5 watts per channel amplifier (36W PMPO), bass and treble boost, volume control, selector switch and mike jack. Includes power adaptor.
C 4199

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Improve your posture and typing practices with this Ergonomic Win 95 keyboard. Front-tilt legs, built-in palm-rest, PC AT/PS2 compatibility.
X 8915

$49.95

Keyboard Win 95

Features a tactile membrance keyswitch, standardised low profile DIN, tilt mechanism, double-shot injection keycaps, PC/AT/PS2 compatibility.
X 8243

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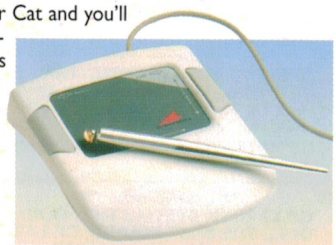
Replace your mouse with a CIRQUE Power Cat and you'll zoom, sketch, scroll or Net-surf with single-finger control. All mouse-button operations performed through touchpad using glide-point technology. Includes signature software.
XH 0002

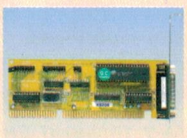
$149



IO EXPANSION CARDS

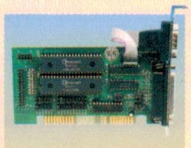
Joystick card This 2-port card allows connection of two joysticks/joypads/steering wheels to your computer. Uses an 8-bit slot.
X 2043

$19.95



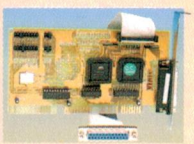
ISA Bus Serial Card with one 16C650 UART with 32-byte FIFO buffers. Needed by fast serial peripherals.
X 8238

$42.95



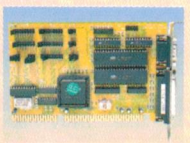
DSX Multi-Port Card ISA card has two serial and two parallel ports. Uses a 16-bit slot.
X 2336

$49.95



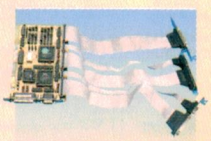
ISA Parallel Printer Card creates two more parallel ports. Uses a 16-bit slot.
X 2548

$49.95



ISA Bus Serial Card with three 16C650 UARTs (serial ports) with 32-byte FIFO buffers. A must for high-speed serial peripherals. Uses a 16-bit slot.
X 8235

$79.95



Multi I/O card with 4 serial ports (16550 UARTS) and 3 Parallel ports with 16-byte FIFO buffer. Uses a 16-bit slot.
X 2582

$99

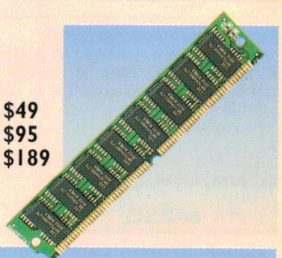
MEMORY

EDO 72-pin SIMMs

8MB	2 x 32-60*	EDO	X 3388	**$49**
16MB	4 x 32-60*	EDO	X 3390	**$95**
32MB	8 x 32-60*	EDO	X 8884	**$189**

* 60 Nanoseconds

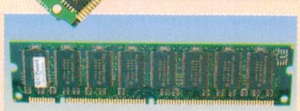
From **$49.95**



168 Pin Synchronous DRAM

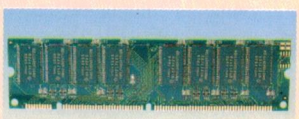
16MB 2 x 64 X 7378

$109



32MB 4 x 64
X 7379

$199



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PHONE: 1300 366 644 (Local Call Charge) **FAX:** (02) 9395 1155
MAIL: **DICK SMITH ELECTRONICS,** Direct Link Reply Paid 160, PO Box 321, North Ryde NSW 2113 (No Stamp Required)

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